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A HAND BOOK
OF
AYURVEDIC MATERIA MEDICA
WITH
principles of Pharmacology & Therapeutics.

VOL. I

By
Dr. H. V. Savnur, L. M. & S.
Consulting Physician.

1950

PUBLISHED BY
Dr. JATHAR & SONS.
MARUTI STREET, BELGAUM.

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स्वर्गीय-पद्मभूषण वैद्यरत्न पं. शिवशर्माजी के
पुण्यस्मरणार्थ उपहारस्वरुप प्राप्त

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Dedication

To all lovers of Ayurved who have in any way contributed to the spread and progress of Ayurved, this book is dedicated by the author as a token of respect and admiration.

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R. H. Bhadkamkar,

M. A.; M. D.

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प्रस्तावना

डॉ. एच्. व्ही. सावनूर यांनीं लिहिलेला हा ग्रंथ अनेक दृष्टीनें अपूर्व असा आहे. देशी औषधीद्रव्यांचा अर्वाचीन पद्धतीनें पृथःकरणपूर्वक अभ्यास करून प्रयोगात्मक अनुभवानें त्यांचे गुणधर्म इंग्रजी वाचकासाठीं ग्रंथरूपानें लिहून ठेवण्याचें श्रम आजवर अनेकांनीं केलें आहेत. व अशा प्रयत्नांनीं देशी वैद्यकांतील औषधीद्रव्यांच्या गुणधर्मावर अर्वाचीन परिभाषेमध्यें प्रकाश पाडण्यांत आला आहे ही गोष्ट खरी आहे, परंतु डॉ. सावनूर यांचा प्रयत्न याहून फार भिन्न स्वरूपाचा आहे. आयुर्वेदांमध्यें ज्या असंख्य द्रव्यांचा वापर नेहमी करण्यांत येतो व ज्यांचे गुणधर्माचें स्वरूप विशिष्ट पद्धतीला अनुसरून मोठमोठ्या प्राचीन निघंटूमधून अनुभवाचें रूपानें सांठवून ठेविले आहेत, ते जगापुढें इंग्रजी भाषेंतून अतीशय सुलभतेनें व मूळ विचारसरणींतील विषयांची मांडणी कायम ठवून मांडण्याचें फार महत्वाचें व अतीशय कठीण असें काम डॉ. सावनूर यांनीं या ग्रंथानें तडीस नेलें आहे, असें म्हणण्यास हरकत नाहीं. ग्रंथाची भाषा अतीशय सोपी असून विषय प्रतिपादन अचुक व सहजगम्य असें आहे. त्यामुळें आयुर्वेदीय तत्त्वज्ञान सुलभ करून जगापुढें मांडण्याची मोठी कामगिरी डॉ. सावनूर यांनीं पार पाडिली आहे असें म्हणण्यास हरकत वाटत नाहीं. त्रिदोष-विज्ञान, द्रव्यगुणशास्त्र, रोगनिदान व चिकित्सा या चार विषयांवर आयुर्वेदशास्त्राची उभारणी आहे. यांतील प्रत्येक विषय दुसऱ्याशीं निगडित असा आहे. पण त्यापैकीं दोषविज्ञान व द्रव्यगुणशास्त्र हे मौलिक विषय आहेत. दोषविज्ञानाशिवाय आयुर्वेदीय रोगविज्ञानाचें प्रकाशन होऊं शकत नाहीं. द्रव्यगुणशास्त्र हा तर चिकित्साशास्त्राचा पायाच आहे. डॉ. सावनूर यांनीं या चार विषयांपैकीं द्रव्यगुणशास्त्र या मौलिक विषयाचा अभ्यासपूर्वक ग्रंथ लिहिला आहे. औषधीद्रव्यांचे गुण तपासून पाहण्याची आयुर्वेदीय पद्धति औषधी द्रव्यांच्या क्रिया पाहूनच निर्माण झाली आहे. ज्या शरीरावर

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या क्रिया घडून येतात त्या शरिरांतील घटक कशा तऱ्हेचे आहेत व त्यांच्या क्रिया कशा चालतात म्हणजेच त्यांचे गुणधर्म काय आहेत हेहि पाहणें आपणांस जरूरीचें असतें. कारण आयुर्वेदीय द्रव्यगुणपद्धति ही औषधी-द्रव्यांचे बाबतींत व शारीरिक द्रव्यांचे बाबतींत भिन्न अशी नाहीं. म्हणून डॉ. सावनूर यांना द्रव्यगुणशास्त्राचा ग्रंथ लिहितानांहि आयुर्वेदीय त्रिदोष-धातु-मूळ सिद्धांताचीहि तात्त्विकदृष्ट्या ओळख करून देणें भाग पडतें. हें प्रसंगास उचित असेंच घडलें आहे. हें करीत असतां मात्र त्यांनीं फारच अभ्यासपूर्ण दृष्टी वापरली आहे असें म्हणणें भाग आहे. कारण वैद्यकशास्त्रांतील सिद्धांत व्यवहारोपयोगी ठरण्यास नित्य व्यवसायात्मक अनुभवाची जोड असावी लागते. केवळ तर्कावर आधारलेलें प्रतिपादन वैद्यकशास्त्रांत निरुपयोगी ठरतें. या दृष्टीनें पाहिलें असतां डॉ. सावनूर यांनीं फार सखोल असा अभ्यास करून आयुर्वेदाच्या त्रिदोष-विज्ञानासारख्या मौलिक विषयाचा गाभा अत्यंत तर्कशुद्ध व स्पष्ट अशा भाषेंत ग्रंथारंभीं विस्तारानें प्रतिपादिला आहे. आयुर्वेद हा सांख्यशास्त्रांतील तत्त्वज्ञानाचा पुरस्कार करीत असल्यामुळें त्या शास्त्राची सर्वसामान्य माहितीहि प्रासादिक विचारसरणीचा पाया म्हणून डॉ. सावनूर यांनीं मोठ्या मार्मिकतेनें ग्रंथारंभीं सांगितली आहे व त्रिदोष विज्ञानाचें विस्तारानें निरूपण करीत असतां अर्वाचीन आहारशास्त्र व योगशास्त्र यांच्या आधारें विषयाचें स्पष्टीकरण अधिकांत अधिक व सुबोध व तत्त्वनिष्ठ करण्याचा त्यांचा प्रयत्न उत्कृष्ट साधला आहे यांत शंका नाहीं. आयुर्वेदीय पंडितांमध्यें त्रिदोष-विज्ञानाबद्दल जे विवाद्य मुद्दे उत्पन्न होतात. त्यांजवर प्रकाश पाडण्यास व अर्वाचीन शास्त्रविज्ञान व आयुर्वेदीय तत्त्वज्ञानाची फोड करून त्यांच्या भाषेंत त्यांना ती समजावून देण्यास डॉ. सावनूर यांच्या ग्रंथांतील हा भाग पुष्कळच उपयुक्त ठरेल. कारण डॉ. सावनूर यांचे विचार अर्वाचीन शरीरक्रिया शास्त्रांतील प्रत्येक विषयांशीं सुसंगत असे आहेत. दोष, धातु व मल हीं द्रव्यें असून त्यांचे परस्पर संबंध व त्यांचा शरीरक्रियेमधील संबद्ध भाग यासंबंधीं ग्रंथामध्यें फार मुद्देसूद वर्णन आहे. विशेषतः या दोषांपैकीं वात या दोषाचे

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जे पांच प्रकार सांगितले गेले आहेत त्यांचें योगशास्त्राचे मदतीनें केलेलें विवेचन अर्थपूर्ण व उद्बोधक असें आहे. त्रिदोषविज्ञानाची स्पष्टता व तन्मूलक पंचमहाभूतांचा सिद्धांत या संबंधीचें विवेचन ग्रंथारंभीच केलें गेल्यामुळें आयुर्वेदाच्या अगदी नवीन वाचकांस देखील ग्रंथांतील मुख्य विषय जो द्रव्यगुणशास्त्र तो समजण्यांस पुष्कळ मदत होईल यांत शंका नाहीं.

ग्रंथांतील मुख्य प्रतिपाद्य विषय जो द्रव्यगुणशास्त्र त्याचें विवेचन क्रमशः, द्रव्याची व्याख्या, द्रव्याचें स्वरूप, द्रव्याचे वर्ग, इत्यादि पद्धतीनें करीत गेल्यामुळें ग्रंथकारानें केलेली पुस्तकाची रचना, आयुर्वेदीय द्रव्यगुणशास्त्राचा अभ्यास करणाऱ्या विद्यार्थ्यांस देखील उपयुक्त ठरेल. आयुर्वेदीय द्रव्यगुणशास्त्रामध्यें वनस्पतिशास्त्रदृष्ट्या द्रव्याची ओळख व रासायनिक पृथक्करणाची माहिती या दोन गोष्टींची अर्वाचीन विज्ञानाच्या मदतीनें भर घालणें अत्यंत आवश्यक होऊन बसलें आहे. पण अशी भर घालीत असतां कार्यकारणपूर्वक त्याचें विवेचन करणारा डॉ. सावनूर यांचा पहिलाच ग्रंथ आहे असें म्हणण्यास हरकत नाहीं. शारीर-क्रिया-विज्ञानाचा विषय स्पष्ट करीत असतां स्थूल व सूक्ष्म पचनाचा तुलनात्मक अभ्यास म्हणून आयुर्वेदीय विषयाबरोबर अर्वाचीन फिजिऑलॉजीमधील जो भाग ज्याप्रमाणें या ग्रंथांत योग्य प्रसंगीं उधृत केला गेला आहे त्याचप्रमाणें औषधी द्रव्यांचीं कार्यें सांगतांना आयुर्वेदीय ग्रंथ प्रतिपादन केल्यावर त्याबरोबरच अर्वाचीन पद्धतीनें सांगण्यांत येणारा द्रव्यकर्माचा विषय सांगितला असून रासायनिक पृथक्करणाची उपयुक्तता विवेचनपूर्वक प्रतिपादण्यांत आली आहे. मात्र या बाबतींत तुलना करण्याची जबाबदारी वाचकांवर सोपविण्यांत आली आहे. या ग्रंथांतील हा भाग अभ्यासू विद्यार्थ्यांस उपयुक्त व मार्गदर्शक ठरणारा असा आहे.

डॉ. सावनूर हे स्वतः आयुर्वेदीय औषधांचा उपयोग करणाऱ्यांपैकीं एक असल्यानें व आयुर्वेद शास्त्राचा त्यांचा अभ्यास सखोल असल्यामुळें या ग्रंथाला अनुभवाची देखील जोड मिळाली आहे. ग्रंथकर्त्याचा अधिकार व

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ग्रंथाची रचना ही पाहिली असतां हा ग्रंथ आयुर्वेदीय वाङ्मयांत अपूर्व असा आहे. डॉक्टर, वैद्य व विद्यार्थी यांना द्रव्यगुणशास्त्राचा अभ्यास करीत असतां क्रमिक पुस्तकाप्रमाणें उपयोगी पडणारा असा हा ग्रंथ आहे यांत शंका नाहीं.

ता. १३।१।४७
डेक्कन जिमखाना,
पुणे ४

रा. ह. भडकमकर

TRANSLATION OF Dr. BHADKAMKAR'S INTRODUCTION.

Judged from many points of view this book by Dr. H. V. Savnur is an altogether a new attempt. Many have, before now, studied the indigenous drugs in the light of modern science, chemical analysis and laboratory observations and have ably set forth their properties, actions and uses in modern scientific terminology for the benifit of english knowing readers. And still Dr. H. V. Savnur's book stands in a class by itself as it differs from its predecessors in many respects. The therapeutical value and the properties of the innumerable drugs in common use in Ayurved, have been, after clinical experience, treasured up in ancient Nighantus in the old style, and Dr. Savnur has achieved the important and difficult task by laying them before the world in an easy style and yet without disturbing the presentation in the original. The style is as simple and elegant as the exposition accurate and lucid-and they together go a long way in presenting the Philosophy of Ayurved in a from easily intelligible to the reader. While Tridosha-Theory, Pharmacology, Etiology and Diagnosis, which are closely related, from the four-fold foundation of Ayurved, the first two enjoy a special position as without knowledge of Tridosha and their deranged forms the causes of disease cannot be investigated, whereas without a knowledge of Pharmacology accuracy in treatment cannot be maintained. Dr. Savnur has chosen Pharmacology the subject of his present work after a deep and careful study in all its aspects. The Ayurvedic method of determining the properties

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of drugs are evolved from the observation of their actions and reactions on the human organism. And it is therefore necessary to study carefully the structural units of the human organism on which the drugs act and also the process of interaction between the ultimate units of drug and organism. For, the Ayurvedic Dravya-Guna-Paddhati (द्रव्यगुण पद्धति) does not make any difference between the drug constituents and the body constituents. Therfore Dr. Savnur has at the beginning of the book appropriately explained clearly, logically and at length the elements of the fundamental theory of Tridosha-Vidnyana (विज्ञान). While doing this he has devoted remarkable assiduity to the study of the subject and has brought to bear his personal practical experience on it. Because, before the medical theories are accepted as practicable they should be substantiated by practical experience. Mere theoretical argumentation based on inference, if full of sound and fury, signify nothing. As Ayurved accepts some of the principles of the Sankhya System of philosophy for explaining the Tridosha-Theory Dr. Savnur has devoted an adequate portion of the book to explain the fundamental concepts of that system so as to enable the reader to understand the Tridhatu-Theory properly. While writing on Tridosha-Theory he has well succeeded in making the subject lucid, intelligible and compatible with realistic notions with special reference to modern dietetics as well as Yoga Philosophy. This section of the book will be highly useful to clarify some of the knotty points in the Tridosha-Siddhanta (त्रिदोष सिद्धांत) raised by the Ayurvedic pandits and to explain to them in their own language, by unfolding the principles of modern as well as Ayurvedic science. Dr. as, Savnur's views are quite in harmony with modern physiology. The book very methodically expounds the theory that Dosha, Dhatu and Mala are material objects and discusses their inter-relations and the part played by them in the Physiological processes. Especially the discussion, regarding the different locations of Wata [वात] n the human body and the functions it performs there

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explained with the help of Yoga-shastra, is instructive and interesting. The theory of Tridosha Vidnyana [त्रिदोष विज्ञान], and the related panch-bhautika Theory having been clearly discussed at the beginning of the book, even readers newly introduced to Ayurved will find it helpful to understand the pharmacology the subject matter of the book.

The different aspects-definition, nature, classification of drug pharmacology, the main theme of the book, have been dealt with in an excellent succession, and as such the book is calculated to be of utmost use to the students of Ayurvedic Pharmacology. It has become imperative to bring to the aid of Ayurved the modern methods of Botany and chemistry for the identification of plants and analysis of drugs respectively. While doing this the subject has to be treated logically-with reference to cause and effect. And judged according to this standard it can be said without reservation that 'Dr. Savnur's book is the first of this kind. While elucidating the subjects of Ayurvedic Physiology, corresponding portions of Modern Physiology regarding general and detailed processes of digestion have been quoted in a befitting manner for the benefit of comparative study. Similarly, while enumerating the action of drugs according to Ayurved, care has been taken to explain these according to the modern science, relevant portions whereof have also been quoted, and the utility of chemical analysis has been aptly stressed. But a regular comparison of the two methods is left to the reader. This portion of the book is instructive and will serve as a guide to the inquisitive student.

The book has also the advantage of having the benefit of practical experience of Dr. Savnur as he has thoroughly studied Ayurved and has been using Ayurvedic medicines in his practice. Considering the author's ability and the lay-out of the book it may be said that the book constitutes an entirely new type of production in Ayurvedic literature. It is instructive to vaidyas and doctors and tends to serve as a hand book of Ayurvedic Pharmacology and Therapeutics to students.

Date 13 1-1947.
Poona.

R. H. Bhadkamkar.
M. A.; M. D.

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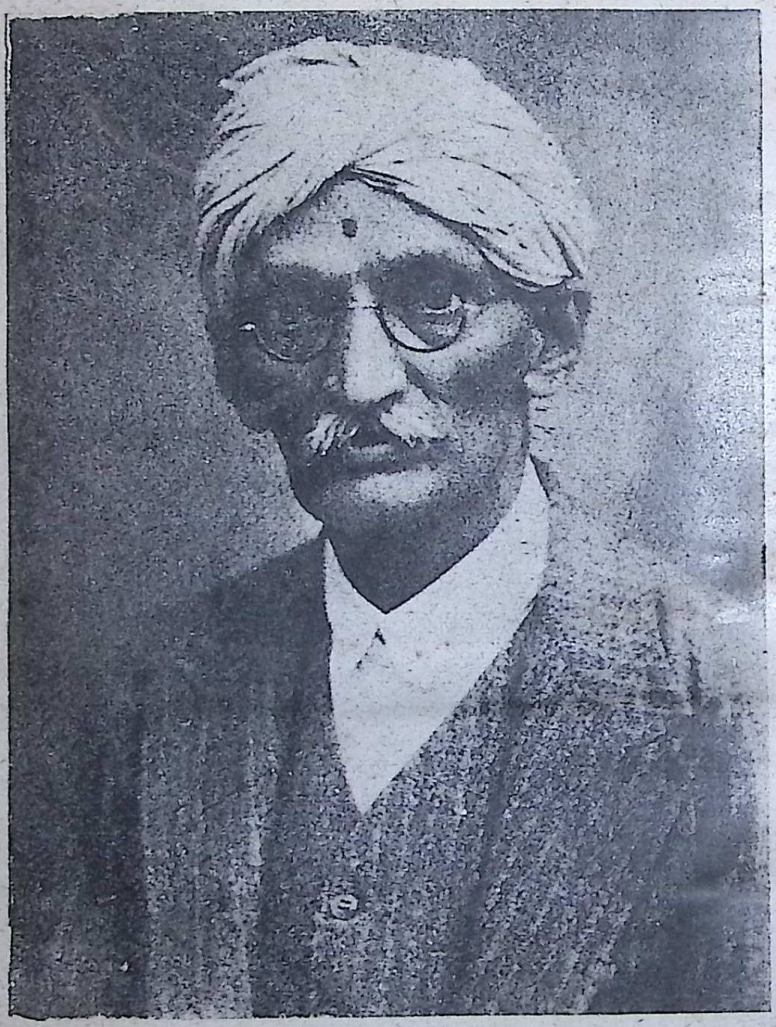

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PREFACE

A number of books on the subject of Ayurvedic Materia Medica, written both by Englishmen and Indians, have appeared in the past. But a complete hand-book of Vegetable Materia Medica fit enough for the use of students working in the Anglo-Ayurvedic Schools and Colleges was a long felt want. The present work is intended to satisfy that want, at least partly, and is written in the style adopted by writers on modern Materia Medica, preserving the principles governing the pharmacology and therapeutics in Ayurved. Though some of the drugs growing in India are admitted in the British Pharmacopoea the method of writing adopted by modern pharmacologists differs from that of the Ayurvedists, as the theories and hypothesis of the two systems differ. It may be true that the investigation of the value of drugs adopted by the Ancients depends, as in modern medicine, upon the effect of drugs on the subjective and objective symptoms caused by either internal or external etiological factors. But the aim of Ayurved does not stop here. It requires that the application of a remedial drug, Rasa-dosha-sannipata रसदोषसन्निपात should be in accordance with the Dosha, Dooshya, Bala, Kala, Anala Satmya etc., as stated by Charaka first and emphasised by Wagbhat afterwards. It must be pointed out here that the emphasis laid by the Ayurvedic teachers is more on the deranged Doshas and the vitality of the patient, and not on the malady only. Again, it is not the drugs that count in Indian medicine, nor do the Pathogenic Organisms that invade the constitution of man carry weight, but it is the reestablishment of the body equilibrium and the maintenance of organic resistance which claim more attention and treatment. In this connection Charaka's words deserve mention.

याभिः क्रियाभिर्जायंते शरीरे धातवः समाः ।
सा चिकित्सा विकाराणां कर्मतद् भिषजांस्मृतम् ॥
त्यागाद्विषमहेतूनाम् समानां चोपसेवनात् ।
विषमा नानुबध्नति जायन्ते धातवः समाः ॥ च. सू.

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What more can masters of medicine and pioneers of any therapy in the World say? Ayurvedists before giving a list of useful drugs have wisely thought out a classification of drugs which would facilitate the adoption of a clear line of treatment; and this classification amounts to " शमनं कोपनं स्वस्थहितं द्रव्यमिति त्रिधा।" —वाग्भट It is clear that Wagbhat, in this statement, refers to remedies which provide a clue to the correction of Doshas, the recognition of potency in drugs which creates action or reaction in the body tissues, and of those which maintain health. It should be noted at the outset that the pathology of Ayurveda is based on Dosha-Vaishamya and Dhatu-Vikriti. The later is accepted by the Westerners whereas the former is not. Disease is described as

कुपितानां हि दोषाणां शरीरे परिधावितां।
यत्र संगः स्ववैगुण्याद् व्याधिस्तत्रोपजायते॥

And the very constitution of the body is defined as

शरीरं नाम चेतनाधिष्ठान भूतं पंचमहाभूतविकारसमुदायात्मकम्।

and the agents which supports this body are stated as दोषधातु मलामूलं सदा देहस्य . These fundamental statements show how the course of the channel of Ayurvedic thought runs. Each of the three groups of Doshas possesses it own ROOPA, GUNA, KARMA, BHEDA and also STHANA. This qualification of the Doshas and Dhatus involves the consideration of the vital force, the tissues, their groups, organs and their physiological functions. A general description of these groups and sub-groups has been given by both Charak and Sushruta. So it may be conjectured that for purposes of understanding the general principles of Physiology, Pathology, Etiology, and medicinal treatment, the Ayurvedists rested on the belief that a general knowledge of these was enough. It will be found that their method of writing was more generic than specific. This is because the periods in which Ayurved and the six Darshans came to light were close to each other. Modern physiologists do not believe in any specific vital energy-Prana-Vayu प्राणवायु but the term vital force is used by them " as it is a convenient

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one, for expressing something which is not as yet understood, and something that cannot at present be brought into line with the physical and chemical forces that operate in the in-organic field ''. In the case of Ayurvedists it cannot be said that they could have developed their science in the way in which the moderners have done. Because their view-point in the fundaments was different.

In Ayurved Dravya, Guna and Karma have their own technical meaning. The Dravyas are classified as सेंद्रिय and निरिंद्रिय. The Gunas are not merely 'attributive' but they are indicative of a biochemical relationship between Dravyas and Dravyas. The Karmas are methods of treatment depending upon the Gunas, such as, लंघन, बृंहण, रूक्षण, स्नेहन स्वेदन, and स्तंभन. Following this line of thought Charak gives in detail the gunas of drugs required to fulfil the indications of treatment referred to above. A sort of correlation [साधर्म्य] is seen between Dravya, Guna and Karma. It was recognised by the Ancients that there is a common organic biological basis on which the constitution of animals and vegetables depended. That is to say, the same laws that regulate the laws of vegetable life are also to be found operating in animal beings. Because the real nature of the biochemical processes whereby the organism converts the potential energy of its food into work and heat was acknowledged by the Ayurvedists. These similarities and in some cases individual characteristics with diversities in nature added to them have greatly engaged the thoughts of the ancient physicians and driven them to the study of nature, its products and its laws. The sense implied in

सर्वदा सर्व भावानां सामान्यं वृद्धिकारणम् ।
ह्रासहेतुर्विशेषश्च प्रवृत्तिरुभयस्यतु ॥ ४३ च. सू. अ. १

shows the trend of Ayurvedic conceptions regarding the properties and application of medicinal remedies.

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Ayurved, in short, as a science constitutes an attempt to understand the laws and the facts of the universe, and this attempt is well seen in the PANCHA-BHAUTIKA THEORY which is adopted as a basis for the super-structure of the whole of the Ayurvedic literature. It is on account of this feeling of cosmic consciousness which is begotten by the PANCHA-BHAUTIKA THEORY that psychology and natural philosophy have had their place in Ayurvedic Medicine.

"Initiation of an old system is a never-ending ritual" says a great author, Yet this is necessary as years roll on. The system might have lost its name on account of unfavourable times and a consequent stages of progress. The underlying motive might have lost its importance as the country's political and social levels have become low. But it must rise again as the idea, the principle, and not the method, still lives and agitates the thinking mind. Such has been the case with Ayurveda during the last one or two centuries. The Tridosha theory, which has evolved from the idea of the Pancha-bhautika source of the universe, is a key to the elucidation of Pharmacological, Pathological, and Therapeutical factors in the treatment of disease. Ayurved admits the principles of naturopathy and homeopathy. It concurs with allopathy that both the rational and symptomatic methods of treatment are necessary. It denies that the human body is only a passive agent, but asserts that it is a most active participator in nature's attempt to get rid of toxic deposits [आम] which are only an impediment in the normal functioning of the system.

So far as remedial measures are concerned the theory of Tridosha, which is the essence of Ayurved, does not stand in need of specifics but calls for the application of such principles as are involved in बस्तिर्विरेको वमनं तथा तैलं घृतं मधु (वाग्भट सू.) words which suggest a key to the treatment of Vata, Pitta and Kapha Doshas respectively. Similarly the classification of

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drugs into वातसंशमन, पित्तसंशमन, कफसंशमन गणs made by Sushruta (Ch. 39 Sootra-sthana), clarifies all doubts arising from the allegation that the Tridosha theory is imaginary and so without any basis. He also gives a long list of drugs in which each of the six rasas pridominate (ch. सू. 42). If it had been really baseless the drugs selected to remove वात, पित्त, कफ Doshas in pursuance of this theory would have turned out to be useless. But it is not so. The actual results of their use contradict the allegation and prove that the knowledge is obtained by clinical experience.

So whatever claims other therapies may put forward in the field of medicine, the place of indigenous drugs in the prevention and cure of disease by Ayurvedic methods will ever remain constant and unchallenged. In dietetics too the same principles are in enunciated. The use of Indian drugs which has been perpetuated through the last twenty centuries, in spite of the contact with foreign culture, substantiates the above statement. India as history records has preserved her medical system in the face of foreign rules to which it had to submit as ordained by ill fortune. This is because the system is based on logic and rational ideas. There may be some deficiencies, but these are due to want of progress and development. There can be no two opinions with regard to the fact that the deficiencies should be revised, rectified, and supplemented. By doing this we shall be following the suggestions made by Charaka in chapter VIII VIMANA-STHANA, regarding the acceptance of what is good, useful, and at the same time scientific in other systems of medicine. It should be recognised again that Ayurved is written in a concise (सूत्रबद्ध) form. The technical expressions used in writing the details of pharmacology are remarkably terse and have their classical meaning. There is no doubt that these require an amplification. The attempts made in framing the subject of Drayaguna have been in consonance with the Indian methodology based on physical, physico-chemical and biochemical principles. If the

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Westerners have placed their faith in laboratory experiments for the assay of drugs the Ayurvedists have relied on observations and experiences accruing from प्रत्यक्ष, अनुमान, & आप्तागम for the same purpose.

It may briefly be stated that Ayurved has combined in itself the science of the body, mind and spirit-vital force. It is the belief of the Ayurvedists that there is enough material in the constitution of man which would form a subject for thought, on the part of Philosophers and Biologists alike. The cause of this train of thought is the belief that man is a dual being having his source in PURUSHA and PRAKRITI. Philosophy and science are not regarded by Orientals as water-tight compartments, but are permitted to influence each other as parts of one organic whole of knowledge. It is necessary therefore that both the Easterners and the Westerners should seriously attempt to know each other's mind and assimilate the best feature of each for their mutual benefit and for the good of mankind. The Ancient Hindoos, by the very nature of their position and environment, developed an introspective mentality and started, in their search of the ultimate verity of life, from अव्यक्त to व्यक्त whereas the Westerners proceeded in pursuit of the same through a scientific analysis of the external phenomena-from व्यक्त to अव्यक्त. The enquiry into final causes (परिणामवाद) has been omitted by modern physiologists under the supposition that the subject comes under theology. In fact, it is not so. Ayurvedists while borrowing some principles from the Darshanika दार्शनिक texts have taken care to mould and adjust them according to the needs of the medical science. Sushruta forseeing that misgivings may arise on this point clarifies the problem by putting some limitations to the definitions of Prakriti and Purusha [क्षेत्रज्ञ]. He says ×

× × वैद्यके तु ।

स्वभावमीश्वरं कालं यदृच्छां नियतिं तथा ॥

परिणामं च मन्यन्ते प्रकृतिं पृथुदर्शिनः ॥ ११ सुश्रुतशरीर. अ.१.

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continuing in the same strain he adds

आयुर्वेदशास्त्रसिद्धांतेष्वसवर्गता क्षेत्रज्ञा नित्याश्च तिर्यग्योनिमानुषदेवेषु संचरन्ति धर्माधर्मनिमित्तं; त एतेऽनुमानग्राह्याः परमसूक्ष्माश्चेतनावन्तः शाश्वता लोहितरेतसः सन्निपातेष्वभिव्यज्यन्ते, यतोऽभिहितं पञ्चमहाभूतशरीरिसमवायः पुरुष इति; स एष कर्मपुरुषश्चिकित्साधिकृतः ॥१६॥—सुश्रुत शारीर अ १

So the presentations of the problems of Ayurved by the old teachers, like Sushruta and Charaka, lay to rest all the charges made against it by some followers of modern medicine, on the supposition that it hinders progress and stops further research. Ayurvedists on the contrary have frankly laid the way open for further development. Surrounded, as the Ayurvedic student is, by the glare of modern civilisation it is but natural that his eyes should be dazzled by the latest developments in the science of medicine. He may at first sight deem that the ancient theories are only mythological. But it is far from the truth. The past is not a dead material but a living force for new discoveries. The persent is the out-come of the past and the future would be the out-come of the present. The outward forms of culture may change but the essentials cannot be changed. In reviewing, therefore, the occurrences of the past especially those which are concerned with the philosophic minds, it is proper that we should not run to hasty conclusions at the first and cursory reading of the Ayurvedic Theories but should give sufficient thought and study to them and then endeavour to judge for ourselves the truth or other-wise of the basic principles.

It is necessary, therefore, that the Ayurvedic student should be able to evaluate the indigenous plants both from the standpoints of Pancha-bhautika Theory and आगम, that is the knowledge obtained by experience. He should be able to understand the different combinations of matter and energy (रूप, गुण and कर्म) in the dravyas-द्रव्यs— which form his remedial agents. It need not be said now that the Ayurvedic Pharmacology, with the complex character of its terminology,

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cannot be understood without a previous study of premedical subjects, such as सांख्य, तर्क and वैशेषिक. It is equally necessary that he should study modern Anatomy and Physiology so as to be able to understand the secrets of Ayurved.

The Indian द्रव्यसंग्रह is naturally very large as it is prepared on the basis of पांचभौतिक theory. Charak admits this and says नानौषधिभूतं जगति किंचिद्द्रव्यमुपलभ्यते तां तां युक्तिमर्थं च तं तमभिप्रेत्य Etc. (Ch. 26 Soo).

The statement is undoubtedly wide as it is applicable to the requirements of medicine, dietetics and hygiene. For medical purposes only a limited number is enough Charaka has defined what a medicinal article Dravya —द्रव्य— should be, in the same article.

We have selected only two-hundred-sixty-six drugs as we think that they would be enough to serve the purpose in treatment. The expression "Indiginous drugs", as we understand, is not employed too literally but it implies such plants also as are Introduced in India and completely naturalised; for instance, Banafsha, Chopachinni and papra-Podophlli- have been admitted into the book in consideration of their medicinal value, though they belong to other pharmacopoeas. Regarding drugs whose identification is still doubtful attempt has been made to clear the confusion by given authoritative opinions of botanists as well as of Vaidyas who have travelled all over India for the identification of plants.

PLAN OF THE WORK.

The book is divided into three parts. Out of these the first part contains general theories regarding the actions of drugs as understood by both the Ancient and modern writers. The most important of these - important because it is concerned with Ayurvedic medicine - is the **Tridosha Theory** to which many of the pages of this part are

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dedicated. As it is very difficult to understand the **Tridosha -Siddhanta** separate chapters have been devoted to considerations of (1) the evolution of matter and energy from **Prakriti** and **Purusha.**, (2) select portions from सांख्य, वैशेषिक and तर्क systems of Indian philosophy, (3) and the subject proper of **Tridosha-Siddhanta** including its morphological, physiological, and pathological phases. At the end of this part, methods of investigation of disease and the principles of Ayurvedic pharmacology have been explained. The latter is treated at length.

The second part consists of the description of the sources of drugs, their collection and preservation, their physical and chemical characters, their forms of preparations, their modes of action, the pharmaceutical processes, modes of administration, doses, weights and measures. Besides these details a separate article on the proximate principles of organic drugs has been given for the information of such of the Ayurvedic students who wish to have an initiation into biochemistry. A knowledge of the important active principles in a drug will certainly help the standardisation of those drugs which are now more popular and are in general use. Plant-analysis is a science by itself and requires a special study without which the various ingredients of different character are not easily made out. It is especially useful in the case of drugs which have a specific action (प्रभाव) no matter whether the property comes from Rasa, Guna or Veerya of the plant or from its constituents. CHARAKA fore-saw the difficulty of recognising the विशिष्टकर्महेतु in a drug, and this can be seen in his expressions such as

किंचिद्रसेन कुरुते कर्म वीर्येण चापरम् ।
द्रव्यं गुणेन पाकेन प्रभावेण च किंचन ॥ (चरक सू अ. २६)

It may be the opinion of some Ayurvedists that plant-analysis, in a whole-sale manner, has a limited scope. Those who hold this opinion should know that plant-analysis is one of the means of finding out drug-value. Moreover pharmacology, as applied in therapeutics; in each of the two schools has its

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foundations in the basic theory adopted by each. But there can be no two opinions with regard to the advisibility of doing laboratory researches which after all conform our previous experience in the wards and thus fortify the usage of drugs against all possible errors. It should always be understood that modern laboratory methods are mainly intended to develop our insight and broaden our out-look regarding the possibilities of science. " The art of discovery " as Sir Francis Bacon said " grows with discoveries ".

The third part embraces a detailed description of medicinal plants, their names in different languages, their habitat, the parts used, botanical characters, chemical composition, preparations and their actions and uses. These descriptions have been taken from the writings of renowned authorities. The descriptions of plants are specially intended for the information of rural medical practitioners as well as the non-medical educated society whose inclination may direct them to the study of botanical characters of plants.

Under the heading of preparations we have given a large number of "standard" preparations and also simple prescriptions used in various diseases, for the information of students and practitioners. These have been collected from different standard works. A separate bibliography is attached elsewhere. The art of writing prescriptions, in fact, can only be learnt after one actually begins to practise. The combinations of drugs and the formulae now laid before the reader are only meant to serve as a guide. Selections have to be made in accordance with opportunities as they arise. In connection with this item the only hint that we can submit to the reader is, as given in case of गण by सुश्रुत, समीक्ष्य दोषभेदांश्च मिश्रान् भिन्नान् प्रयोजयेत् । पृथङमिश्रान् समस्तान् वा गणं वा व्यस्तसंहतम् ॥४२ सू. अ.३८

A summary of the actions and uses of each drug is given at the end.

The pharmacology of each drug is selected from the Nighantus and given in original sanskrit verse.

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Explanations regarding the actions of drugs are given in pursuance of both Ayurvedic and modern methods wherever it is possible to do so. The therapeutical uses have been explained with reference to the action of the drugs on the Doshas as well as organs. In some cases the emperical uses of plants have been given and these are founded on the experiences of physicians. They may be accepted on their merit.

Before concluding we have first, to express our thanks to those authors from whose works quotations have been taken and to those editors of journals, pamphlets and reports, both Ayurvedic and allopathic from whose articles information on various subjects has been gathered. Then we must record our indebtedness to Dr. R. H. Bhadkamkar M.A., M.D. for having gone over the major portions of the manuscript and encouraged us to publish it. In fact, we have no words to express our obligations to the doctor who, in spite of his bodily infirmity, readily consented to write a foreword to the book. After writing this, we cannot remain without giving vent to our feelings of gratitude to Dr. C. L. Jathar for helping us, almost as a coworker, by going through the original manuscript, copying it and typing it. But for his assistance the manuscript, which was rolling in dust for years, would not have seen the day. We must next acknowledge our sincere thanks to Mr. D. S. Naik. B.A., S T.C of Sankeshwar for correcting the first two parts and bringing them up to proper form, and also for making valuable suggestions when the work of revision was going on. Our thanks are again due to those learned medical men of scholarly distinction who frankly pointed out the mistakes committed, in the earlier days of writing this book. Lastly we have to express our gratitude to Mr. K. R. Mohite, the proprietor of the Sona Printing Press for getting this book printed in time, and to Mr. Phataka for preparing the blocks.

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AYURVEDIC MATERIA MEDICA.

PART I.

THEORY OF AYURVEDIC PHARMACOLOGY.

CONTENTS.

CHAPTER. I. Page

THE PRINCIPLES OF AYURVEDIC PHARMACOLOGY. 1- 18

Introduction; scientific validity of the hypothesis of Darshanas.

Sankhya theory of evolution; (Purusha) पुरुष, (prakriti) प्रकृति, (Mahat) महत्, (Ahamkara) अहंकार, (affected by Trigunas) त्रिगुणs, (Manas) मनस्, (Indriyani) इंद्रियाणि, (Pancha-tan-matra) पंचतन्मात्रा, (Pancha-maha-bhutani) पचंमहाभूतानि. Pancha-bhautic theory of matter. Comparison with the modern western views.

CHAPTER II

THE TRI-DHATU THEORY 19—39

(a) The origin of (tri-dhatus) त्रिधातुs from (pancha-mahabhutas) पंचमहाभूतs; (roopa) रूप, (guna) (गुण, and (karma) कर्म of (Pancha-maha-bhutas) पंचमहाभूतs, traced to (trigunas) त्रिगुणs: the three Primal constituents; (shareera :- शरीर: the embodiment of (tri-dhatus) त्रिधातुs, and (trigunas) त्रिगुणs, with their transformation.

(b) Comparison of the forces of nature with the (sookshma-dhatus) सूक्ष्मधातुs, of the body.

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(c) (Tridhatus) त्रिधातुs form part of the six (padarthas) पदार्थs, viz., (dravya) द्रव्य, (guna) गुण, (karma) कर्म, (samanya) सामान्य, (vish-sha), विशेष, (samavaya) समवाय; interpretation of these relations according to (vaisheshika) वैशेषिक, and (ayurved) आयुर्वेद.

(d) (karana-dravyas) कारणद्रव्यs — (ahamkara) अहंकार, (tanmatra) तन्मात्रा; (karya-dravyas) कार्यद्रव्यs-(indriy-artha) इंद्रियार्थ, (indriya) इंद्रिय, and (shareera) शरीर, (pancha-bhautica) (पांचभौतिक) (purusha) पुरुष, — the sixth (dhatu) धातु.

(e) Meaning of (tridhatu) त्रिधातु— (tridosha) त्रिदोष with explanations regarding their (roopa) रूप, (guna) गुण, and (karma) कर्म; (tridhatu) त्रिधातु—(tridosha) त्रिदोष are symbolical expressions denoting physiological functions and pathological derangements; (sookshma) सूक्ष्म and (sthoola) स्थूल (dhatus) धातुs their part in the development and destruction of the body.

(f) (tridhatus) त्रिधातुs instrumental in forming the constitution (diathesis) of man; how they correspond to the different stages in life; child-hood, adolescence and oldage. How they are affected by the changing hours of the day and the night; and by the seasonal changes. How they co-ordinate with the digestive processes of the body.

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(b) (sapta-dhatus) सप्तधातु their formation (upachaya) उपचय. ....; part played by (agni) अग्नि; the thirteen (agnis) अग्निs.

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(c) Physiology of (vayu) वायु Relation of (vayu) वायु with the (shat-chakras) षट्चक्रs; Relation of (vayu) वायु with the mind (manas) and analysis of psychic processes and those of (vayu) वायु in the human body.

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(f) General function and scope of (kapha) कफ; Normal function of the five (kaphas) कफs: (avalambaka) अवलंबक, (kledaka) क्लेदक, (bodhaka) बोधक, (tarpaka) तर्पक and (shleshaka) श्लेषक, in detail.

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(d) Clinical examination:
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19. Vikashi विकाशि
20. Visha विष
21. Pramathi प्रमाथि
22. Vidahi विदाहि
23. Abhishyandi अभिष्यंदि
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8. Antilithics
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10. Antiphlogistic
11. Antipyretic, Febrifuge
12. Antirheumatic
13. Antiscorbutics
14. Antiseptics
15. Antisialagogues
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17. Antizymotics
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2. Nose: [nasya] नस्य, [dhoomra-pana] धूम्रपान.

3. Eye: [netrakarma] नेत्रकर्मः— [seka] सेक, [pindika] पिंडिका, [ashchotana] आश्चोतंन, [bidalaka] बिडालक, [anjana अंजन, [tarpana] तर्पण.

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4. Head: [Shiro-basti] शिरोबस्ति.

5. Intestines: [basti-karma] बस्तिकर्म, [anuvasana] अनुवासन, [nirooha] निरूह.

6. Genital organs: [phala-varti] फलवर्ति, [vikeshika] विकेशिका, [varti] वर्ति, [pichu] पिचु.

7. Body:

(a) [snehana] स्नेहन, [panchakarmavidhi] पंचकर्मविधिः [vamana] वमन, [virechana] विरेचन, [nirooha] निरूह, [anuvasana] अनुवासन, [nasya] नस्य; [abhyanga] अभ्यंग, [lepana] लेपन, [dhoopana] धूपन.

(b) [swedana] स्वेदन;

(i) Ayurvedic methods:— [tapasweda] तापस्वेद, [ushmasweda] उष्मस्वेद, [upanahasweda] उपनाहस्वेद, [dravasweda] द्रवस्वेद.

(ii) Modern methods: Kinds of bath. Cold bath, Cool bath, Tepid bath, Warm bath, Very hot bath, Vapour bath, Continuous bath, Turkish bath, Medicated bath.

8. Some remedies useful in surgical diseases:— [darana] दारण, [peedana] पीडन, [rorana] रोपण, [shodhana] शोधन, [pachana] पाचन, [utsadana] उत्सादन, [avasadana] अवसादन, [vimlapana] विम्लापन, [avasechana] अवसेचन, [sandhana] संधान, [nirvapana] निर्वापण, [ksharakarma] क्षारकर्म.

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(e) Alimentary canal: (1) mouth (2) stomach (3) intestines. (4) rectum.

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(a) General remarks regarding dosage.
(b) Modifying circumstances relating to the patient.
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SECTION V

Prescription for children.....

SECTION VI

Weights and measures.....

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VITAMINS I-XVIII

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AYURVEDIC MATERIA MEDICA.

PART I

CHAPTER I

THE PRINCIPLES OF AYURVEDIC PHARMACOLOGY.

(1) Introduction.

(2) Scientific validity of the hypothesis of the Darshanas.

(3) The Sankhya Theory of Evolution.

(4) The Pancha-Bhautika Theory of Matter.

(5) Comparison with the Modern Western View.

Ayurvedic Pharmacology does not, like the Western Pharmacology, deal with the actions of the drugs on the body and its various parts with reference only to Chemistry, Physics, and Pharmacology, as such, but also with reference to Metaphysics as propounded by the great thinkers of yore who wrote the षड्दर्शनs - Shad-Darshanas.

The Ayurvedists are thoroughly justified in doing this, for, in the history of Science the theological phase comes first, then the metaphysical and lastly the physical. Similar conceptions are also met with in the philosophic works of the Greeks. Auguste Comte, the foremost of modern French thinkers, has also laid down a similar hypothesis. Again, these theories are not altogether alien to European thought, for though some of the European scholars do not accept these theories, still the latter do exist in Europe in one form or the other. All the Natural Sciences, for instance, assume that a world of matter exists altogether independently of the perceiving mind, whereas mechanical science (Mechanics), on the other hand, assumes this matter to have ' mass ' and to exert ' force ', defining these terms, however, merely phenomenally. So it is no wonder if such a school of thought, with a limited purpose, does not favour a discussion on the grounds of over-subtility, because it sounds metaphysical. But if we look at the beginnings of these sciences, it will be realised that all the so called special

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sciences are marked off from one another, for the sake of convenience only; but a day will surely dawn when they all will, in due course, run into one body of Truth. The Ayurvedists have, therefore, based their Physiology on Metaphysics which not only provides a key word to the understanding of Physics and Bio Chemistry which form the groundwork of Physiology, but also helps to understand the pharmacology of drugs as well as the constitution of man by explaining the different theories in connection with the 'Creation of the World-Matter' It is, therefore, of the utmost importance that the student of Ayurveda acquaints himself with the fundamental theories of the Shad-Darshanas, a very brief account of each of which hereafter follows.

The Shad-Darshanas are:—

1. Vedanta,
2. Yoga,
3. Nyaya,
4. Vaisheshika.
5. Meemamsa,

and 6. Samkhya.

The *Vedanta* and the *Yoga* deal directly with the subject of the Divine Being.

Though *Nyaya* and *Vaisheshika* appear to be secular sciences, still they deal with their subjects in a way that eventually leads us to the realisation of the Deity. The great exponents of these Darshanas, Gautama and Kanada respectively, have clearly demonstrated how the ordinary methods of Logic and Physical Sciences end in revealing the great truths of Religion. Sage Kanada, in particular, has laid bare a complete picture of Nature and the Universe with reference to their physical phases.

Meemamsa is the science of exegetics which lays down the principles of the art of scriptural interpretation. This science plays a very important part in the expansion as well as in the improvement of the human knowledge.

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Samkhya has taken up a positive stand which almost corresponds to the position of a modern Positivist. The discussions and arguments in this Darashana are of a purely scientific character and bear on the practical side of life. The Mahabharata and the Bhagavadgeeta have followed suit, and adopted the Samkhya philosophy in their interpretation of Karma-Yoga.

The Ayurvedists also have adopted the principles of Kapila as expounded in the Samkhya-darshana as basis for the interpretation of the 'Creation of the World'. It is, therefore, necessary for the student of Ayurveda to study these in some detail with a view to gaining the maximum possible insight into the composition of the world as a whole in general and of the development of man and his species in particular.

THE SANKHYA SYSTEM.

The Fundamental Concepts:—Though different are the ways in which the systems view the universe, still Salvation emancipation from the bondage of Pain is the common goal which each one of them strives to reach. There are certain fundamental concepts which dominate these systems and give them this particular cast. The concepts are:—

(1) The Soul is immortal,
(2) As you now sow so shall you reap: The power of Karma,
(3) The world is full of pain,
and (4) Pain is due to the faults arising out of the ignorance of man, and that by the acquisition of the knowledge of the highest Truth it is possible for us to free ourselves from it.

The concepts explained :- The Soul, immortal as it is, does not perish like the body, which is rightly described by Shakespear as 'the muddy vesture of decay', but passes from body to body till the influence of all the previous misdeeds has worked itself out and sin has paid its price. As man is not

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perfect, he does commit errors and every error he commits, whether wittingly or unwittingly, he must expiate by a life of misery. This causes the continual transmigration of the Soul. It must be noted here that ignorance is at the root of the whole evil. Therefore the Sankhya Philosophy starts by positing the existence of pain consequent upon human faults caused by ignorance and declaring the desirability of extirpating it:—

दुःखत्रयाभिघाताज्जिज्ञासा तदभिघातके हेतौ ।
दृष्टे साऽपार्था चेन्नैकान्तात्यंततोऽभावात् ॥ १ ॥

—सांख्य कारिका

Translation:—"On account of the attacks of the three kinds of pain, there arises an enquiry into the means of their removal. If the enquiry be found superfluous because of the existence of obvious means, the reply is 'No' owing to the absence of finality and absoluteness in them."

And the remedy prescribed for the removal of Pain is the acquisition of the knowledge of the Highest Truth–the cognition of the Principles of Being–that restores to the Atman the consciousness that it is of Divine origin and that all attachment to the object of sense is delusive. When this is realised the carnal bonds fall off and the Soul, recognising its own nature, once more dwells apart in the grandeur of its moral and spiritual independence. By the bye, it must here be said to the credit of the great thinkers of Ancient India that there is nothing loftier or nobler than this conception of the liberated soul, in possession of the Higest Truth and identified therewith, from which all frailties which the flesh is heir to have retired, and the eternal calm whose content no transient fancies vex.

SANKHYA THEORY OF EVOLUTION :—

It is not possible to understand the complete significance of these concepts unless we thoroughly study the ways in which the Universe and its Evolution were viewed by the different

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Darshanakaras, particnlarly by the Sankhyas and to some extent by the Vaishe-shika which have been adopted by SUSHRUTA and CHARAKA. We now, therefore, proceed to give the same herebelow ;

The Sankhya Yoga describes the Order of Evolution succinctly in the following words :—

सत्वरजस्तमसां साम्यावस्था प्रकृतिः ।
प्रकृतेर्महान्, महतोऽहंकारो,—ऽहंकारात् पंचतन्मात्राणि
उभयमिंद्रियं, पंचतन्मात्रेभ्यः स्थूलभूतानि ।
पुरुष इति पंचविंशतिर्गुणाः ।

सांख्य १—६१

Thus according to the Sankhyas all the things that we see in this world are looked upon as the result of the transformation within one Primal Substance -प्रकृति (Prakriti), the first cause of the universe of everything excepting only Soul which is uncaused. This is known as परिणामवाद (Parinamavada) 'The Theory of Evolution.' The primal subtance Prakriti cannot be directly perceived but requires to be inferred. This inference is based on reflection substantiated by rationalistic explanation (अनुमान—Anumana). This Anumana led the Sankhyas to recognise the existence of another independent reality, namely, the Purusha (पुरुष) without whose सान्निध्य (influence), as the Sankhyas believed, the Prakriti would not be active. Thus Purusha is held to be the chief principle the Spirit the Atman-the very soul of Prakriti. Prakriti and Purusha virtually act as one. Prakriti represents the body and Purusha the soul. The coming together of Prakriti and Purusha is the first step in Evolution. Then proceed from Prakriti the seven evolutes—'प्रकृतिविकृतयः.' They are महत् (Mahat), otherwise called बुद्धि (Buddhi), अहंकार (Ahan-kara) the Ego, and the five तन्मात्रs (Tanmatras). Thus it will be seen that the first evolute of Prakriti is Buddhi. From Buddhi is produced Aham—kara.

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Then four classes of evolutes, totalling sixteen in all, issue from Aham-kara: From a combination of Rajas and Satvika Aham-kara the ten इंद्रियs (Indriyas)—the five senses or instruments of knowledge (पंचज्ञानेंद्रिय) and the five senses or instruments of action (पंचकर्मेंद्रिय) and मनस् (Manas)—Mind-- a sense, an instrument both of knowledge and action are derived; and from a combination of Rajas and Tamas Aham-kara the five तन्मात्रs (Tanmatras) are evolved. And then from these Tanmatras the five elements-- भूतs (Bhootas)-- पृथिवि (Prithivi), अप् (Ap), तेजस् (Tajas), वायु (Vayu) and आकाश (Akasha) issue forth.

"The Order of Evolution of the twenty-four principles (Tatvas) known to the system, if we exclude the Purusha which stands outside the realm of change, will be seen from the following scheme :

TABLE NO. 1

1. Prakriti.

2. Mahat—Buddhi.

3. Aham-kara.

4. Manas.	5 — 9. Sensory organs.	10-14. Motor organs.	15-19. Tanmatras.
			20-24. Bhootas.

The complete significance of this scheme and of the various terms used in it will become clear as we proceed." (Prof. Hiriyanna).

The Principles of Being: The Principles of Being are Primarily two : the Knower and the Known, or, the Subject of knowledge and the Object of knowledge. Neither by itself is sufficient. Various may be the forms in which the objective

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Principle manifests itself, quite infinite the Objects of knowledge, but there is one feature common to all, viz, that they are all *Objects of knowledge* and so other than the *Subject of knowleage*. The Subject of knowledge is called 'Purusha' and the object of knowledge 'Prakriti'. -As Prakriti is the primordial cause of the Universe-of everything excepting only Soul which is uncaused and accounts for whatever is physical, both matter and force, it is called 'प्रधान' (Pradhana). All creation is the result of a relationship established between these two. Still there is a unity which underlies this duality.

Purusha or Soul— is described as being a passive agent, an embodiment of intelligence, eternaly, unthinkable, self-existent, supernatural, untouched, unsullied, blameless, all-pervading yet unproduced, undestroyable and unchangable.

तस्माच्च विपर्यासात् सिद्धं साक्षित्वमस्य पुरुषस्य ।
कैवल्यं माध्यस्थ्यं द्रष्टृत्वमकर्तृभावश्च ॥

—कारिका १९

Translation : And from the contrariety (before specified Soul is proved to be a witness, solitary, neutral, perceiving and inactive.

Prakriti or Nature : is characterized by universal potency, and holds in itself the possibility of all forms. It is very subtle and therefore cannot be readily recognised; however, it is not non-existent, for its acquaintance is gained through its forms when it is modified by the Subject. Therefore Kapila—deva wisely describes it by a negative-अव्यक्त i. e. non-manifest, the indiscrete. As Prakriti is the Primal Cause of Creation, everything that is seen, heard, tasted, felt and smelt in this world comes from it only. In substantiation of this the Sankhyas put forth the following arguments as expressed in कारिका put forth

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भेदानां परिमाणात् समन्वयात् शक्तितः प्रवृत्तेश्च ।
कारणकार्य विभागाद् विभागाद्वैश्वरूपस्य ॥ १५ ॥
कारणमस्त्यव्यक्तं प्रवर्तते त्रिगुणतः समुदायाच्च ।
परिणामतः सलिलवत् प्रतिप्रतिगुणाश्रयविशेषात् ॥ १६ ॥

Translation : Because of the finite nature of specific objects, because of the homogeneity, because of production being from energy. because of discreetness between cause and effect, and because of unity in the Universe.

There is a (general) cause, Nature, (which) operates by means of the three Constituent Powers, by conjunction and modification (varying) like water with particular receptacle of the several powers.

Nature is discerned when it is in a manifest state and its forces are let loose. When Nature is in a state of equilibrium (aggregation) there is no creation. The non-manifest Nature (Avyakta) exists in the form of a homogeneous continuum. This continuum is described by the Evolutionists of India as "the equipoised condition of certain forces."

These forces are three, viz. Satva, Rajas and Tamas. The first of these may be rendered as 'Force of Stable Existence', the second as 'the Force of Attraction' and the third as 'the Force of Repulsion'. When these forces, which are innate in Nature, are disturbed the equilibrium fails and there is creation. When this aggregation is broken up, they revert to their original state of equipoise and there is dissolution. Thus synthesis builds up the world and analysis destroys it. This is expressed by the Sankhyas thus :

साम्यवैषम्याभ्यां कार्यद्वयम् ।

It will thus be seen that the process of evolution was conceived in those olden days in a way not very unlike that current in modern times, for Herbert Spencer says. "Evolution is an

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integration of matter and concomitant dissipation of motion, during which the matter passes from the indefinite incoherent homogeneity to a definite coherent heterogeneity; and during which the retained motion undergoes a parallel transformation." In a like manner the world assumes different concrete forms.

Further, as Nature by itself cannot do anything even with the help of the three constituents-Trigunas, the Purusha or the Atman has to interfere and co-operate with the Avyakta and make it Avyakta-manifest i. e. convert it from its subtle existence to a gross one. Atman, the unknowable principle, has, therefore, to modify itself into a cognisable form. It then becomes subject to 'experience', in consequence of association with Mahat or Buddhi. The Discriminative knowledge here intervenes, and Nature, both in its equipoised condition, viz., of goodness Satva, passion-Rajas and darkness-Tamas, and the diversified condition of gross forms, presents itself before the Soul Atman. This is expressed in the following karika :

सर्वं प्रत्युपभोगं यस्मात् पुरुषस्य साधयति बुद्धिः ।
सैव च विशिनष्टि पुनः प्रधानपुरुषांतरं सूक्ष्मम् ॥ ३७ ॥

Translation : As it is Intellect which accomplishes for self the fruition of all that is to be experienced, so it is that, again, which discriminates the subtle difference between Soul and Nature.

It must not, however, be lost sight of that this knowledge or experience or consciousness, by whatever term it is described, is not independent but as the Sankhya-Sootra itself says :

अंतःकरणस्य तदुज्ज्वलितत्वात् लोहवत्अधिष्ठातृत्वम् ।

It gets its light from the Buddhi. The third phase in the evolution of the universe is the appearance of the first evolute 'Buddhi' which is pure and simple in its constitution. In this stage the perception is exceedingly dim and faint and without definitude and particularity.

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The extent of perception gradually expands and gives birth to Aham-kara i.e. a very vague consciousness of the Ego (self). Nature now exhibited is very different from Nature in its pristine simplicity. The forces Satva, Rajas and Tamas are now at work. Out of the darkness which existed before the creation, came out the rudimentary elements-Tanmatras (Tat-that; Matra- only) which are subtle substance the elements of which are the holders of the species of Sound Touch, Colour, Taste and Smell; these substances are by themselves incapable of producing any pain, pleasure or dullness; they are neither the varieties of gross elements; they are five in number and each possesses one quality or essence of a substance undiversified.

तस्मिंस्तस्मिंस्तुतन्मात्रे तेन तन्मात्रता स्मृता ।
न शान्ता नापि घोरास्ते न मूढाश्चविशेषिणः ॥

—सां. कारिका

The Tanmatras and their qualities are so subtle that one cannot tell them apart; in fact no distinction can be made between a subject-the pre-existent cause and its property-the manifest effect (object). Hence the Hindu logic-the cause (Karana) is known by and termed after the effect (Karya). The potential appears as the actual and the indiscreet as discreet. This is corroborated by Kapila-deva in his Sutras which Ishvarakrishna puts in the following verse Karika No. IX.

असदकरणादुपादानग्रहणात् सर्वसंभवाभावात् ।
शक्तस्य शक्यकरणात् कारणभावाच्च सत् कार्यम् ॥

Translation : An effect (pre) exists (in its cause), because of the non-existent being uncaused, of the employment (by men) of material means, of the absence of universal production, of the effecting of the possible (only) by a competent agent, and of the nature of a cause.

Thus "The theory of causation is based upon the metaphysical view that effect follows cause. A cause is regarded as a

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potential effect. Even before the causal operation the effect exists in identity with the cause. The function of the causal operation is not to produce anything new but to actualize the cause as the effect or to exhibit manifestly in the effect what was already contained in the cause."

The same is said in Shareerasthana by WAGBHATA :

कारणानुविधायित्वात् कार्याणां तत्स्वभावता ।

—शा. वाग्भट

These rudiments or rather rudimentary elements form the very basis of the Hindu Physics. The ancient sages did not classify elementary states of matter as 'solid' 'liquid' and 'gaseous,' but they classified them only into five varieties according to their perception by the five senses. Even the modern conception of 'atom' as being a complex proto-electron system finds a parallel in this Hindu idea of Evolution of matter. The particles or electrons of matter assume various forms according to the preponderance or otherwise of the intrinsic forces and result in the production of bodies. These theories have also been verified by Lamarcke and Darwin in the 19th century.

The Pancha-Bhoota Theory of matter :—

For purposes of chemical analysis and synthesis all substances were looked upon by the ancients as being made up of पंचभूतs (Panchabhootas)—the five gross elements viz., Ether, Air, Fire, water and Earth. These elements were taken to be the different states of matter. The परमाणुs (paramanus) of the chemical elements may be said to be the combinations of these five states of matter in different proportions. The important element forming the protomatter occupies the centre as the nucleus, while the remaining four elements occupy the periphery. In Indian Philosophy, the proto-matters are likened to Tanmatras which may be translated as 'charges' of specific energy. It must be noted here that the word 'energy' is used here only with reference to

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matter. These Tanmatras i. e. rudimentary elements are, as it were, the foundations of the five types of matter charged potentially with the energy of (1) Sound (Vibration), (2) Touch (Tangibility), (3) Heat and Light, (4) Taste and (5) Smell. According to the Sankhyas, they are arranged in groups wherein the proportions increase by permutation and combination, शब्दतन्मात्रा (Shabda-tanmatra) being held as the starting point. Ether proto-matter, Shabda-tanmatra, is charged with vibration; Tactile-Sparsha-tanmatra-with vibration and tangibility; Light and Heat-Rooptanmatra-with vibration, tangibility and, heat; Taste-Rasa-tanmatra-with vibration, tangibility, heat and taste; and Smell-Gandha-tanmatra-with all the preceding in addition to smell. So all the atoms of substances, whether animate or inanimate are secondary and tertiary combinations of these Tanmatras charged with forms of energy arranged centrally and peripherally as stated above. This is one of the explanations *put upon* the arrangement of States of Matter. As regards the exact nature of these types there is some difference of opinion among different schools of thought. Sankhya looks upon the Tanmatras as simultaneously evolved out of Aham-kara. "There is another variant of the theory: According to this Shabda (sound) is the first tanmatra. It gives birth to Akasha from which is produced the second tanmatra, Sparsha (touch). Form this issues forth Vayu. Vayu, in turn, gives birth to the colour tanmatra which, in its turn, evolves Tej. The rest of the process can be easily followed (Sampurnanand).

Trigunas:— Now arises the question – whence do these sense-energies get their strength? The answer is not far to seek. It is from the original three affective principles' of nature (Prakriti), viz, सत्व (Satva) रजस् (Rajas) and तमस् (Tamas) that all proto-matters and threefore atoms, as a matter of course, get their impulse. These three principles are nothing but essences of Nature in which all the physical and physico-chemical energies, such as the rudimental potential energies, and kinetic energies like heat, sound, electricitiy etc. are included.

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In reference to these three principles SUSHRUTA says.

.....सर्व एवाचेतन एव वर्गः, पुरुषः पंचविंशतितमः कार्यकारण-संयुक्तश्चेतयिता भवति।....तत्र कारणानुरूपं कार्यमिति कृत्वा सर्व एवैते विशेषाःसत्वरजस्तमोमया भवंति। तदंजनत्वात्तन्मयत्वाच्च तद्गुणा एव पुरुषा भवन्तीत्येके भाषन्ते ॥ १२ ॥

— शरीर. अ. १

Translation: The twenty four Tatvas (till now mentioned) are all gross (inanimate) forms; Purush, the twenty-fifth, in whom both Cause and Effect mingle, is really the primal mover; in other words, he is responsible for all life.

In obedience to the law that 'effect follows-corresponds to cause,' all these evolutes of Nature assume Satva, Rajas and Tamas gunas. Some Acharyas are of opinion that individuals assume-inherit-qualities of Triguṇas as they bear their nature and are made of them.

In short, these three forces rule the destiny of all things, animate and inanimate. Men cannot escape from their influence unless Satvaguna prevails over the other two and overpowers them. In this connection CHARAKA says.

रजस्तमोभ्यां युक्तस्य संयोगोऽयमनंतवान्।
ताभ्यां निराकृताभ्यां तु सत्वबुध्या निवर्तते ॥ २५ ॥

— च. शा. अ. १

Translation:—The combination of twenty four tatvas containing Rajas and Tamas gunas are endless; and when these two gunas are set aside (overpowered) by Satvika-guna, the combinations cease to exist. The course of this Evolution moving in a vicious circle is beautifully expressed by CHARAKA thus:

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अव्यक्ताद्व्यक्ततां याति व्यक्ताद्व्यक्ततां पुनः ।
रजस्तमोभ्यामाविष्टश्चक्रवत्परिवर्तते ॥ ६७ ॥

च. शा. अ. १

Translation:—The individual Soul (Purusha) overpowered by Rajas and Tamas renounces his non-manifest form and becomes manifest, and when these two affective principles cease to disturb him, he again becomes unmanifest. In this way he is moving in a circle.

Though described as 'Three' Gunas, one Guna alone is never found isolated from the others ; they are ever a mutually interdependent 'Unity-in-Trinity'. Prof. Vrajendranatha Seal speaks of them thus : "These Gunas are conceived to be Reals, substantive entities not, however, as self-subsistent or independent entiities but as interdependent moments in every real or substantive existence. The Gunas are always uniting, separating and uniting again. Cf.

अन्योन्याभिभवाश्रयजननामिथुनवृत्तयश्च गुणाः ॥ १२ ॥

—कारिका

Everything in the world results from the peculiar arrangement and combination. Varying qualities of Essence, Energy and Mass in varied groupings act on one another and through their mutual interaction and interdependence evolve from the indefinite or qualitatively indeterminate to the definite or qualitatively determinate. But though cooperating to produce the world of effects these divers moments with divers tendencies never coalesce. In the phenomenal products whatever. Energy there is, is due to the element of Rajas, and Rajas alone; all matter, resistance, stability is due to Tamas, and all conscious manifestations to Satva. The nature of the interaction is peculiar. In order that there may be evolution with transformation of energy, there must be a disturbance of equilibrium, a preponderance of either Energy or Mass-resis-

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tance or Essence over other moments. The particular Guna which happens to be predominant in any phenomena becomes manifest in that phenomenon and the others become latent, though their presence is inferred by their effect."

Having described the Evoltuion of Matter from Nature and its succeeding evolutes we now proceed to the classification of the objects of Creation in general. In this connection the Sankhyas say,

अभिमानोऽहंकारस्तस्माद् द्विविधः प्रवर्तते सर्गः ।
ऐन्द्रियएकादशकस्तन्मात्रापंचकश्चैव ॥ २४ ॥

तन्मात्राण्यविशेषास्तेभ्यो भूतानि पंच पंचभ्यः ।
एते स्मृता विशेषाः शान्ता घोराश्च मूढाश्च ॥ ३८ ॥

सूक्ष्मा मातृपितृजाः सह प्रभूतैस्त्रिधा विशेषाः स्युः
सूक्ष्मास्तेषां नियता मातापितृजा निवर्तन्ते ॥ ३९ ॥

पूर्वोत्पन्नमसक्तं नियतं महदादि सूक्ष्मपर्यन्तम् ।
संसरति निरुपभोगं भावैरधिवासितं लिंगम् ॥ ४० ॥

न विना भावैर्लिंग न विना लिंगेन भावनिर्वृत्तिः ।
लिंगाख्योभावाख्यस्तस्माद् द्विविधः प्रवर्तते सर्गः ॥ ५२ ॥

—कारिका

Translation : No. 24 : Self-apperception is egoism. Thence proceeds only a two-fold creation, viz., the eleven-fold set of sense and five-fold set of elemental rudiments.

No. 38: The rudimentary principles are non-specific ; from these five proceed the five gross elements, which are known as specific, since they are soothing, terrific and dulling.

No. 39:—Subtle bodies and also such as spring from father and mother together with the great existences from the three varieties of specific objects. Of these the subtle are everlasting, while those born of parents perish.

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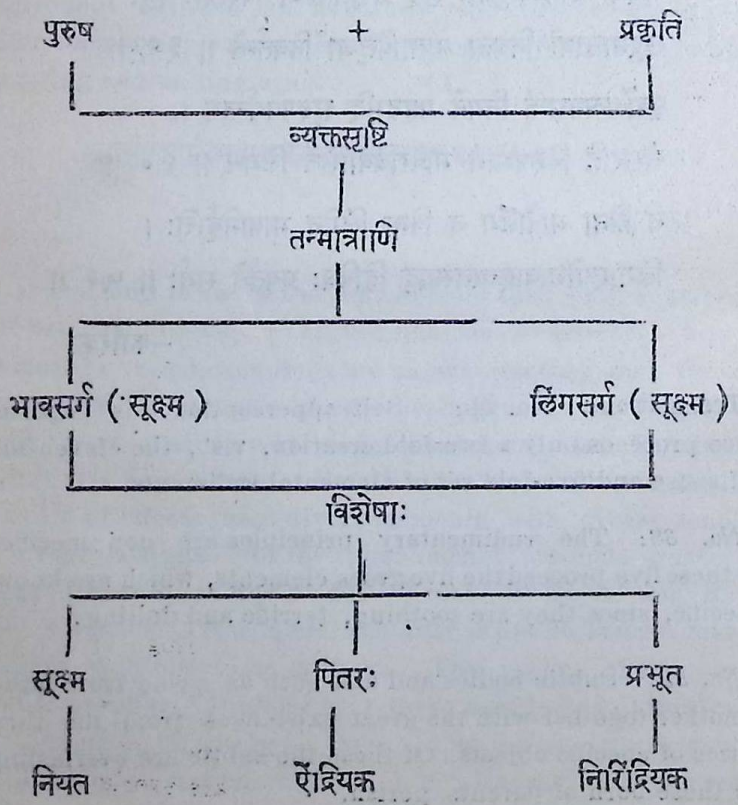
No. 40:—The subtle body, which is primeval, unconfined, permanent and composed of intellect and the rest down to the elementary rudiments, migrates, enjoys not, and is not invested with affections.

No. 52:—If there were no conditions, there would be no subtle persons, and if there was no subtle person there would be no evolution of the conditions. Thence a two-fold creation proceeds, by name Personal and Objective.

These verses can be best illustrated with the help of the following table which shows all the stages in the evolution of creation.

TABLE NO. 2



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Classification of the Objects of Creation : Thus it will be seen that the Sankhyas classify bodies—substances—into two main divisions : (a) अविशेष (Avishesha) Non—specific, and (b) विशेष (Vishesha) Specific. CHARAKA classifies them as (a) ऐंद्रिय (Aindriya) and (b) निरिंद्रिय (Nirindriya). We have to understand the Aindriya (चेतनद्रव्य) creation as consisting of combinations of subtle and gross bodies and the Nirindriya as (अचेतन) purely gross. The Sankhyas classify the Specific bodies further into three divisions : (i) सूक्ष्म (Sooxma) Subtle and therefore everlasting, (ii) मातापितृज Parent—born, and (iii) प्रभूत (Prabhoota)—diversified objects such as plants, stones etc. The first of these, i. e. Sooxma, is rather difficult to understand and therefore needs amplification. The idea is that inasmuch as there are two facts, viz., (1) that the Soul migrates. and (2) that the gross corporate body perishes, one has to presuppose that there is a non-corporal but spiritual frame which, being occupied by the Soul migrates from body to body carrying with it impressions (Bhava) belonging to each previous life. Now we know that the Soul being only a witness and a passive agent is not working actively with any personal interest. But this is explained thus:

It is always acting through the evolutes of Nature and its reflections, such as Buddhi and Ahamkara. As nothing, however, can proceed without a vehicular body carrying Intellect (which again is subject to the influences of the Trigunas) and as actions in life are followed by reactions in the next birth we have to admit that there must be an intermediate rudimentary subtle body, लिंग-शरीर (Linga-Sharira), a receptacle or vehicle for receiving those impressions (Bhava- भाव) and undergoing forms of life according to the respective Karmas. Both the rudimentary (लिंगाख्य) and the intellectual (भावाख्य) creations are attached to the same gross body till it perishes. The Lingasharira is the frame for carrying super-sensible set of Intellect, Self-consciousness, etc. but produces no intuition

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of it; the भावसर्ग (Bhava-sarga) is the Objective Creation formed of conditions apprehended by means of senses, i. e. the assemblage of objects known by perception. Both these creations (Linga and Bhava,) are not separable from each other but are interdependent, forming together the spiritual life. Thus there is continual action and reaction going on between the states of Intellect and those of Body. Each conditions the other. As the rudiments premise the rudimental body, so the latter again premises the gross: for we have already seen that without the gross body there can be no experience. It is because both kinds of bodies are meant that the word ' विशेषैः ' is used in Karika No. 38 already quoted. In other words, Intellectual Creation cannot exist without a support and that support is the gross body bearing a corporal existence.

In short, the bodies, as we see in Nature, according to the Sankhyas are specific substances containing both subtle and gross elements according to their requirement in the animate and inanimate creation. Modern Science divides objects into (1) Organic and (2) In-organic, which, in common parlance, are the same as animate and inanimate respectively. Man, animals, vegetables come under Organic Creation; Man especially is endowed with अध्यात्मगुणसंग्रह i. e.

मनो मनोऽर्थो बुद्धिरात्मा च ।

—च. सू. अ. ८

Before we proceed further it would be useful to bring together here the several postulates to which we had occasion to refer:

" (a) Whatever is, always is, and whatever is not, never is.

(b) Change implies something that changes.

(c) The effect is essentially the same as its material cause.

(d) All variety can eventually be traced to three sources which are not, however, independent but interdependent.

(e) Matter is characterised by perpetual motion.

(f) Neither mind is berived from matter, nor matter from mind. "

– Prof. Hiriyanna.

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CHAPTER II

THE TRI-DHATU THEORY

So much for the Pancha-Bhautika Theory of matter adopted by the Ayurvedists. Now we proceed to the consideration of the **Tridosha-Tridhatu** Theory of Ayurveda.

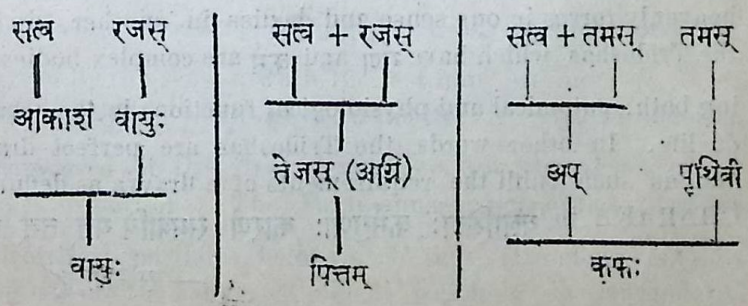
Tridhatu-Tridosha Theory :— The Tridoshas are Vata, Pitta and Kapha, which with the सप्तधातुs and मलs according to to the Ayurvedists, contribute to the formation of the living human body. In the organic world these correspond to the Pancha-bhutas as and when, operated by the Soul. To be more explicit, the Pancha-bhutas, पृथिवी, अप्, तेजस्, वायु and आकाश, make up the whole of our Physical matter, and this, when operated by the Soul, is spoken of as being made up of Vata, Pitta and Kapha, which correspond respectively to Rajas, Satva and Tamas, the Trigunas, which constitute the primal and fundamental triplicity of Nature-Prakriti-characterising manifested existence of all grades. The origin of Tridoshas from the five elementary substances is stated as follows

तत्र वायोरात्मैवात्मा ———————— वायुः

पित्तमाग्नेयम् ———————— पित्तम्

श्लेष्मासौम्यः
अंभःपृथिवीभ्यांश्लेष्मा } ———————— कफः

TABLE NO. 3



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SUSHRUTA describes the Tridoshas thus:—

वातपित्तश्लेष्माण एव देहसंभवहेतवः । तैरेवाऽव्यापन्नैरधोमध्योर्ध्वसन्निविष्टैः शरीरमिदं धार्यतेऽगारमिवस्थूणाभिस्तिसृभिरतश्च त्रिस्थूणमाहुरेके । त एव च व्यापन्नाः प्रलयहेतवः । तदेभिरेव शोणितचतुर्थैः संभवस्थितिप्रलयेष्वप्यविरहितं शरीरं भवति ॥ ३ ॥

— सु. सू. अ. २१

Translation:— It is from Vata, Pitta and Kapha that the human body takes its origin. They are respectively situated in the upper, middle and lower parts of the trunk and support the structure-body, just as three pillars support a building, and hence the name त्रिस्थूण given to it by some Acharyas. When they are diseased they lead to destruction. So, with the aid of these three supplemented by blood as the fourth, the body is maintained in a normal condition.

Thus SUSHRUTA gives us here an idea of (1) what Tridoshas are, (2) what their normal function is, (3) how they take part in pathological processes, and (4) how with blood as a medium they conduct all processes, from birth to death. He further observes.—

विसर्गादानविक्षेपैः सोमसूर्यानिला यथा ।
धारयन्ति जगद्देहं कफपित्तानिलास्तथा

—सु. सू. अ. २१.

Here SUSHRUTA compares the forces Nature with those of the human body. Just as the sun, the moon, and the air are heavenly forces in one sense and bodies in another, similarly the Tridoshas which have गुण and कर्म are complex bodies having both anatomical and physiological functions in the economy of life. In other words, the Tridoshas are perfect dravyas and as such fulfil the requirements of a dravya as defined by CHARAKA in यत्राश्रिताः कर्मगुणाः कारणं समवायि यत् तत् द्रव्यं ।

— सू. अ. १

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Translation:— The substance, in which Guna and Karma are indissolubly united and which is a Samavayi Karana-समवायिकारण—combinative cause is, a 'Dravya'.

Now let us see what dravyas are. The history of Evolution tells us that (1) the Tanmatras, which are rudimentary principles and nonspecific bodies, are Karana-dravyas — (भावरूप) कारणद्रव्य, and (2) the specific bodies, which are the out-come—evolutes-of the Tanmatras, are Karya-dravyas, कार्यद्रव्य and become organic or inorganic according as they are सेंद्रिय or निरिंद्रिय. All bodies, in this way, are naturally Pancha--bhautika in their origin and constitution, but in the process of development where अग्नि is the chief working agent are marked off by changes in the qualities of the constituents. As the qualities change, the results of the actions change. But *substanceness*, i. e, Dravyatva द्रव्यत्व is not anihilated either by Cause-Karana-or by Effect Karya KANADA says,

न द्रव्यं कार्यं कारणं च बधति ।

— वै. सू. १—१—१२

The dravyas according to न्याय, वैशेषिक and आयुर्वेद are nine in number: 1. Prithivee-पृथिवी 2. Ap-अप् 3. Tejas-तेजस्, 4. Vayu- वायु 5. Akasha- आकाश 6. Kala- काल, 7. Dik- दिक्, 8, Atman- आत्मन् and 9. Manas- मनस्. Of these the first five are, इंद्रियगोचर i. e. capable of being perceived by the senses, while the last four are not so, i. e. they are अतींद्रिय. All physical matter is Pancha-bhautika and composed of the five elementary dravyas mixed up in various proportions. The Paramanus-परमाणु of these dravyas are electrified particles belonging to these five elements, thus giving rise to the physical objects which we see around us.

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Dravyas are आकाशीय, वायव्य, आग्नेय, आप्य and पार्थिव. For definitions of these the reader is referred to Table No. IV.

But the dravyas do not by themselves explain the whole universe. They tentatively serve as its frame-work; it must be remembered that they are गुणवत्, कर्मवत् and समवायिकारणs. As compared with गुण and कर्म they are नित्य. We have, therefore, now to consider the categories (Padarthas—पदार्थs) other than dravya. By the term 'category' we have to understand, with the exception of one, the several groups or classes into which objects can be divided and not mere modes of predication. They are गुण—Guna, कर्म—Karma सामान्य—Samanya, विशेष—Vishesha, समवाय—Samavaya, and अभाव—Abhava; and together with dravya, they constitute the seven padarthas of the Nyaya school. Of these, Dravya, Guna and Karma have real objective existence and with them, therefore we are more concerned here. Abhava is rejected by the Ayurvedists and Vaisheshikas.

The remaining are बुध्यपेक्ष, i. e. relative to understanding. We have already spoken about dravya, and we shall now say a few words about each of the remaining six:

(a) **GUNA:** Guna is defined as समवायी तु निश्चेष्टः कारणं गुणः ॥ ५५ ॥

च. सू अ. १

Guna by itself is निश्चेष्ट i. e. inactive. It becomes a Karma when it associates with dravya for the purpose of producing action. So whenever we use the term 'dravya' we mean it, for all practical purposes, to be a combination of dravya and guna.

Gunas are described by CHARAKA as "सार्था गुर्वादयो बुद्धिः प्रयत्नांताः परादयः." These belong to both Chetana-चेतन and Achetana-अचेतन dravyas.

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TABLE NO. IV

N. B.—Shows the general relations between the पांचभौतिकसूक्ष्मद्रव्य and the धातुs.

Prevailing तन्मात्रा	Prevailing type of द्रव्य	Prevailing दोष	Prevailing सप्तधातु in द्रव्यs	Physical & Chemical properties	Pharmacological properties	Physiological properties
गन्ध	पार्थिव	कफ	मांस	स्थूल, सांद्र, मंद, स्थिर, गुरु, कठिन.	मधुर mainly कषाय secondarily	स्थैर्यसंघातोपचयकरम् विशेषतः अधोगतिस्वभावं
रस	आप्य	कफ	रस, मेदस्, मज्जन्, शुक्र	शीत, स्तिमित, स्निग्ध मन्द, गुरु, सर, सांद्र, मृदु, पिच्छल.	मधुर mainly कषाय, आम्ल, and लवण secondarily	स्नेहन-प्रल्हादन-क्लेदन बंधन-विष्यन्दनकरम्
रूप	तैजस	पित्त	रक्त	उष्ण, तीक्ष्ण, सूक्ष्म, रूक्ष खर, लघु, विशद.	कटुक mainly आम्ल, लवण secondarily	दहन-पचन-दारण-तापन प्रकाशन-प्रभावर्णकरम्
स्पर्श	वायवीय	वायु	अस्थिन्	सूक्ष्म, रूक्ष, सर, शिशिर, लघु, विशद.	कषाय mainly तिक्त secondarily	वैशद्यलाघवग्लपन विरूक्षणविचारणकरम्
शब्द	आकाशीय	वायु	आकाशीय common to all द्रव्यs	श्लक्ष्ण, सूक्ष्म, मृदु, व्यवायि, विविक्त.	अव्यक्तरस	मार्दवशौषिर्यलाघवकरम्

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अर्थाः ——— शब्द, स्पर्श, रूप, रस, गंध, Residing in पंचमहाभूत.

गुर्वादयः ——— गुरु–लघु; शीत – उष्ण; स्निग्ध – रूक्ष; मंद–तीक्ष्ण; स्थिर–सर; मृदु–कठिन; विशद–पिच्छिल; श्लक्ष्ण – खर; सूक्ष्म–स्थूल; सांद्र–द्रव;

बुद्धिः ——— धीः, धृतिः, स्मृतिः, अहंकारः

प्रयत्नांतः ——— इच्छा, द्वेष, सुख, दुःख, प्रयत्न.

परादयः ——— परापरत्वे युक्तिश्च संख्या संयोग एव च।
विभागश्च पृथक्त्वं च परिमाणमथापि च ॥ २७ ॥
संस्कारोऽभ्यास इत्येते गुणा ज्ञेयाः परादयः ॥

— च. सू. अ. २६.

(b) **Karma:**—Karma is defined by CHARAKA as

संयोगे च विभागे च कारणं द्रव्यमाश्रितम् ।
कर्तव्यस्य क्रिया कर्म कर्म नान्यदपेक्षते ॥

-- सू. अ. १

Trans:—" कर्म " is a cause both in conjunction and disjunction, and rests in a manner embodied in द्रव्य. Its function lies in doing that which is required of it to be done. It does not require any other condition."

In other words कर्म is action pure and simple, and it manifests only when in combination with द्रव्य and गुण *Gangadhara* the commentator on *Charaka Samhita* says:—

नहि निर्गुणं द्रव्यमस्ति न च अद्रव्यं कर्मास्ति ।
ततः सहकारि कारणं द्रव्यकर्मणोरपि गुणः ।

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(सांख्यकारिका). Following the same line of thought it can be said that त्रिदोषs are the products of पांचभौतिकद्रव्यs invested with qualities (गुण) and the power of action (कर्म). Thus स्पंदन and उत्क्षेपण are कर्मs being the results of the action of वायु residing in the रजोगुण in a द्रव्य.

(c) सामान्य and विशेष.

(i) सर्वदा सर्वभावानां सामान्यं वृद्धिकारणम् ।
ह्रासहेतुर्विशेषश्च प्रवृत्तिरुभयस्य तु ॥

(ii) सामान्यमेकत्वकरं विशेषस्तु पृथक्त्वकृत् ।
तुल्यार्थता हि सामान्यं विशेषस्तु विपर्ययः ॥

(1) Trans:- (1) सामान्य, the common factor existing in dravyas adds to the their strength ; but विशेष gives rise to a conception of their peculiarity consisting in separateness, as a factor leading to deterioration. Both these factors are simultaneously working, when in relation to the body economy. "प्रकृतिरुभयस्यतु" may be compared with" प्रकृत्या च विरोधिना धातूनां वृद्धिह्रासौ भवतः

—च. शा. अ. VI

(ii) "सामान्य brings abont oneness or likeness, and विशेष difference, unlikeness or separateness. सामान्य indicates the fitness to accomplish a common object and विशेष indicates contrariety (अपचय)."

Gangadhara, the commentator, explains (i) सामान्य and (ii) विशेष in the following words :-

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(i) समानानां द्रव्यगुणकर्मणां वृद्धौ
प्रयोजकं सामान्यम् ।

(ii) विशिष्टांनां द्रव्यगुणकर्मणां ह्रासे
प्रयोजको विशेषः ।

So, सामान्यम् वृद्धिकारणलक्षणम्, or एकत्वकरम् or तुल्यार्थता ।
(येन समानं यत् तस्य तेनसह तुल्यार्थत्वं– सामान्यम्)

विशेषः : असमानत्वं or विपरीतत्वं (अपचय) or
पृथक्त्वकृत् or ह्रासहेतुत्वम्

It must be noted here that the interpretation of सामान्य and विशेष in Ayurvedic literature is different from that adopted by the WAISHESHIKAS and NAIYAYIKAS. The WAISHESHIKAS speak of सामान्य and विशेष in the sense of 'genus' and 'species'.

In its highest degree सामान्य expresses only existence (सत्ता) a property common to all BHAVAS. विशेष abides in the nine dravyas (पृथिव्यादि) which are eternal snbstances. Out of these nine dravyas आत्मा, मनस्, काल, दिक्, आकाश are infinite; and the परमाणुs of the remaining four, viz., पृथिवी, अप्, तेजस् and वायु are indivisible. They (अंत्यविशेषाः) have reached the uttermost point, and they are what they are by their indivisible nature. Its theory or doctrine is that all substances are composed of countless minute indivisible particles, from the combinations of which all forms of substances, physical and mental, arise, and from the operation of which all phenomena take place. These combinations are subject to change or destruction, but the indivisible particles cannot be destroyed or altered. This "विशेष" is the distnguishing feature of the वैशेषिक philosophy KANAD, the auther of this दर्शन is a staunch devotionalist,

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and his conception of विशेष is connected with the production of साधर्म्य and वैधर्म्य which inevitabley leads to the supreme Being, as the source of all harmony.

(e) SAMAVAYA: INSEPARARLE INHERENCE.

In this connection CHARAKA says,

समवायोऽपृथग्भावो भूम्यादीनां गुणैर्मतः ।
स नित्यो, यत्र हि द्रव्यं न तत्रानियतो गुणः ॥४९॥

—च. सू. अ. १

स नित्यो यत्रहि द्रव्यं=स समवायः नित्यः यत्र हि द्रव्यं नित्यम्
न तत्रानियतो गुणः=तत्र नित्येद्रव्ये गुणः न विनाशी

Samavaya is the perpetual intimate relation between an object and its qualities; in other words, it is the communion of two things, whereof one, so long as they exist, continues united with the other, e. g. this relation exists between पृथिवी and its gunas.

(f) ABHAVA: NEGATION or NON-EXISTENCE.

It is of four kinds:

(१) प्राग्भाव —Antecedent non-existence, as in the case of a pot before it is produced.

(२) प्रध्वंसाभाव —Subsequent non-existence, as in the case of a pot after it is destroyed.

(३) अन्योन्याभाव —Mutual non-existence, which finds expression in judgments like 'The pot is not cloth.'

(४) अत्यंताभाव —Absolute non-existence; thi variety we have when there is the bare ground with no pot o: it.

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In medical Science Dravya is to be understood as Karya-dravya, as it counts predominantly in the treatment of diseases Dravya is, therefore, represented as Samavayikarana i. e. combinative cause wherein actions (Karma) and attributes (Guna) exist. According to Vaisheshikas even Soul (Purusha) is a dravya i. e. a substance, for though it is devoid of action i. e. change, still it appears to possess action by its contact with mind and the internal origins, in the state of phenomenal existence. Compare

निर्विकारः परस्त्वात्मा सत्वभूतगुणेन्द्रियैः ।
चैतन्ये कारणं नित्यो द्रष्टा पश्यति हि क्रियाः ॥५५॥

—च. सू. अ. १

आयुर्वेदशास्त्रसिद्धांतेषु असर्वगताः क्षेत्रज्ञा नित्याश्च,
तिर्यग्योनिमानुषदेवेषु संचरंति धर्माधर्मनिमित्तम् ॥१६॥

सु. शा. अ. १

It is necessary to state at this stage why the basic elements of the creation are only five. The Samkhyas hold that all the objects in the universe are perceived by men through the five senses (पंचज्ञानेंद्रियs) and that like only can effect like-since without kinship between a sence and its object, its distinctive capacity cannot be satisfactorily accounted for. The organ of sight alone, for example, apprehends colonr, for it alone is made of Tejas atoms whose characteristic quality is colour. Thus as there are only five organs of perception, namely, श्रोत्र, त्वक्, चक्षुष्, जिव्हा, घ्राण, it is natural that all the objects in the world should come nnder the parview of these five senses. The marks of perception which these sense-organs possess are शब्द, स्पर्श, रूप, रस and गन्ध respectively. Each one of these marks can be subdivided into a number of classes, as e.g. रूप can be white, red, yellow etc. In this manner every other mark is capable of innumerable subdivisions, and so we get innumerable different substances each having a different

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proportion of attributes. This fact goes to explain the obvious variety and diversity in the objects of creation. So it was natural for Kapila-deva to classify all objects under the five rudimentary elements Pancha-Tanmatras, already discussed under the head of 'Evolution'. Now the process by which potentiality of objects is manifested into their actuality can be explained as under :

We know that Shabda—शब्द is caused by the vibration of particles of a substance, and that vibration is only possible when the particles have some space to move through. So Space-Shabda is the product of archetypal Sound. (2) स्पर्श—Touch requires both Akasha and Vayu so that the currents of air can pass through and touch the skin. So Vayu is the product of archrtypal Touch. (3) रूप-Tejas requires Space, Air and Fire so that the currents of heat can travel through and touch the skin and impinge on the retina, So Tejas is the product of archetypal Tejas. (4) रस-Savour requires Space, Air, Heat and Humidity so that it can travel through the nerves and be felt and tasted. So Ap is the product of archetypal Savour. (5) गन्ध— Gandha requires Space, Air, Heat, Water and earthy matter so that its particles can pass through all the media and be smelt. So पृथिवि is the product of archetypal Gandha.

Now, it is not accident that brings about this relation between the objects and the organs of sense; it is instinctive nature which is the root-cause. The only explanation why such a correlation exists is given by SUSHRUTA in the following stanza:

इंद्रियेणेन्द्रियार्थं तु स्व स्वं गृण्हाति मानवः ।
नियतं तुल्ययोनित्वान्नान्येनान्यमिति स्थितिः ॥१५ ॥

—सु. शा. अ.

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Translation: In as much as the perception of an object is acquired through the organ of that particular perception, it can very well be inferred that they have an origin common to both, according to the Law of Evolution. So one sense-organ can have the perception of its इन्द्रियार्थ and no other.

It should be noted here that the Samkhya system considers Indriyas as derived from Ahamkara, whereas according to CHARAKA the indriyas are Pancha-bhantika. CHARAKA says, गर्भस्तु स्वल्वन्तरिक्षवाय्वाग्नितोयभूमिविकारश्चेतनाधिष्ठानभूतः; एवमनया युक्त्या पंचभूतविकारसमुदायात्मको गर्भश्चेतनाधात्वधिष्ठानभूतः, स ह्यस्य षष्ठो धातुरुक्तः ॥६॥

—च. शा. अ ४

Translation: Garbha is really a transformation of the five elements Presided over by Chetana (Atman). Hence Garbha is an embodiment of the five elements which have undergone a transformation through the influence of Atman.

Here the term 'महाभूत' connotes the states of matter and not the material substances met with in the physical world. The terms पृथिवी, अप्, तेजस्, वायु and आकाश, as ordinarily understood, are the elements in their mixed forms, AKASHA being the only exception. The distribution of gunas in a dravya being unequal, the relative predominance of a particular guna in a dravya determines its class. The denomination of physical elements depends upon the predominance of a particular guna, constituent. This is expressed by Sushruta in the following table;

1. तत्रसत्वबहुलमाकाशम् –Ether
2. रजोबहुलोवायुः –Air
3. सत्वरजोबहुलः अग्निः –Fire
4. सत्वतमोबहुला आपः –Water
5. तमोबहुला पृथिवी –Earth.

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TRIDOSHAS :

Having thus established that every particle, whether organic or inorganic, is Pancha-bhautika in character, we can naturally conclude that Tridoshas are also Pancha-bhautika dravyas invested with guna and karma. Ayurvedists have recognised these Tridoshas as the principal units on which the body-functions are dependent. They have enunciated the theory of Tridosha for the explanation of the finer and the grosser movements of the body, both in the physiological and pathological aspects. This is described by WAGBHATA in Ashtanga-Samgriha as इत्थमधोमध्योर्ध्वसन्निवेशिना दोषत्रयेण शरीरमगारमिव स्थूणात्रितयेन स्थिरीकृतम् । अतश्च दोषा देहस्य स्थिरीकरणात् स्थूणा इत्युच्यन्ते । धारणाद्धातवः । मलिनीकरणादाहारमलत्वाच्च मलाः दूषणस्वभावाद्दोषा इति ।

— अ. सं. सू. अ. २०

In the gross states Tridoshas nourish the dhatus, sthanas etc. and so form the physical support—Sthoonas, स्थूणाः—but in their finer state, their functions are more important as they regularly take part in the metabolic processes of the body. Their Karmas are संयोजन (Kapha), विभजन (Pitta) and वियोजन (वात) (Vata) respectively. CHARAKA describes them as—

वातपित्तकफा देहे सर्वस्रोतोऽनुसारिणः ।
वायुरेव हि सूक्ष्मत्वाद् द्वयोस्तत्राप्युदीरणः

— च. चि. अ. २८

They are so minute that they can reach any part of the body through the medium of स्रोतांसि. So they are called 'व्यापिनः'. In short, they are the three elementary units from which the whole and every part, from the grossest to the minutest, of the body, is built. They have a place in the cell and out of the cell.

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They enter into the structure of the tissues in various proportions according to physiological requirements. Their constitution is liable to be disturbed at any moment by the slightest agitation. Compare the following from SUSHRUTA AND CHARAKA :

वैलक्षण्यात् शरीराणामस्थायित्वात्तथैव च।
दोषधातुमलानां तु परिमाणं न विद्यते ॥४३॥
—सु. सू. अ. १५

क्षयः स्थानं च वृद्धिश्च दोषाणां त्रिविधा गतिः, ॥११०॥
— च. सू. अ. १७

Thus it will be seen that the Tridhatu Theory goes many steps beyond the Cellular Theory of the Western Physiologists, on to the Panchbhutas and Trigunas ; in fact, the Tridhatu—Physiology of Ayurveda begins where the Orthodox Cellular Physiology of Western Medicine ends.

From the description of the nature of the Tridoshas it will be clear that they are not 'wind,' 'bile' and 'phlegm' as wrongly understood by some ; they are neither 'humours' an understood in the Hippocratic writings. But they are the elementary units of the body pertaining to (1) development—प्रकृति, (2) structure and function—आकृति and (3) derangement—विकृति, when they are in equilibrium (अविकृताः) the health is normal, and when they are deranged through direct or indirect causes, such as असात्म्येंद्रियार्थसंयोग, प्रज्ञापराध and परिणाम, health suffers and disease results. WAGBHATA says,

विकृताऽविकृता देहं घ्नन्ति ते वर्तयंति च ॥

They are, again, to be seen iu every structure of the body, sometimes suppporting and sometimes controlling the actions of one another. Though, in health, they work harmoniously, their behaviour is not antagonistic totally, in disease. Disease appears only when the inherent limit of the repairing power is

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transgressed by indiscretion on the part of the individual. So though apparently opposite in character, they behave in a complementary way towards one another. Nature has endowed them with powers of adjustment, by means of which they can afford to maintain the stability of the body. CHARAKA says,

प्रकृत्या च यौगपद्येन तु विरोधिनां धातूनां वृद्धिह्रासौ भवतः ॥ ३४ ॥

—च. शा. अ. ६

On a consideration of the Evolutionary Theory and the share which the Pancha-bhautika—drayas take in the formation of animal tissues one is led to believe that the movements in the सूक्ष्म-अवयवs, the arrangement of these अवयवs in the tissues, and of the tissues in the organs—all these anatomical and physiological factors depend upon the actions, interactions and reactions of the Tridoshas. In their subtle state they are known as अतींद्रिय, but they can be recognised by their actions (Cf. कार्यतः तदुपलब्धेः—सांख्य).

Gangadhara the commentator of CHARACA—SAMHITA also says

स्थूलभूतैः सूक्ष्मभूतानां कार्यं अनुमानं भवति

In this सूक्ष्म condition they work at the instance of the Mahavayu, Karma and स्वभावः CHARAKA says,

शरीरावयवास्तु परिमाणुभेदेनापरिसंख्येया भवन्त्यतिबहुत्वादतिसौक्ष्म्यादतीन्द्रियत्वाच्च ॥१५॥ तेषां संयोगविभागे परमाणूनां कारणं वायुः कर्म स्वभावश्च ॥१६॥ —च. शा. अ. ७

It is just possible, therefore, that the powers asciribed to Tridoshas, particularlrly to Vayu, are due to some factors, inborn and related to their inherent nature; otherwise, it is not possible to explain why and whence Vayu gets the power of moulding Dhatus. Cf.

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यथार्थमूष्मणा युक्तो वायुः स्रोतांसि दारयेत् ॥२८॥ –सु. शा. अ. ४
सम्यग्गत्या च धातूनामक्षाणां पाटवेन च ॥१/२॥ –वा. सू. अ. ११
दोषधात्वग्निसमतां संप्राप्तिं विषयेषु च ॥१०/१ –सु. नि. अ. १

Now, how Tridoshas are instrumental in the causation of disease is unequivocally expressed by CHARAKA in the following stanzas:

स्वधातुवैषम्यनिमित्तजा ये विकारसङ्घा बहवः शरीरे।
न ते पृथक्पित्तकफानिलेभ्य आगन्तवस्त्वेव ततो विशिष्टाः ॥१७॥
आगन्तुरन्वेति निजं विकारं निजस्तथाऽऽगन्तुमपि प्रवृध्दः।
तत्रानुबंधं प्रकृतिं च सम्यग् ज्ञात्वा ततः कर्म समारभेत ॥१८॥
–च. सू. अ. १९

Translation: (17) Diseases may be many, where the cause can be traced to the internal derangement of tissues; but they cannot be independent of the influence of Vata, pitta and Kapha (i. e, alterations in the metabolism). Accidental diseases, or, those due to external causes, have their own peculiarity.

(18) Complications, secondary in nature, may follow primary diseases; equally so, affections of the primary tissues may follow diseases by accidents and injuries, and even may accentuate. So a physician, before he begins treatment, should ascertain whether the affection is primary or secondary, and mild or severe.

In short, priority in infecting or deranging dhatus rests with doshas and not with the Sapta-dhatus and Malas. SUSHRUTA makes this quite explicit thus दोषधातुमलसंसर्गात् आयतनविशेषात् निमित्ततश्चैषां विकल्पः। दोषदूषितेष्वत्यर्थं धातुषु संज्ञा क्रियते रसजोऽयं, शोणितजोऽयं, मांसजोऽयं, मज्जजोऽयं, मेदोजोऽयं, अस्थिजोऽयं, शुक्रजोऽयं व्याधिरिति ॥८॥

–सु. सू. अ. २४

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Each of these constituents of the body, viz., dosha, dhatu and mala, have their own place and importance in Physiology. The word 'दोष' is used in relation to Vata, Pitta and Kapha. This factor 'dosha', which regulates the whole field of Metabolism, cannot be identified with the supporting tissues दूष्य and मल with which it is always confounded. It is true that the word 'dhatu is, in numerous instances, used in place of dosha, dushya and mala. But they are different; for, their Roopa, Guna and Karma differ from those of the former. The body. however, cannot function without the help of these three constituents. In combination, they from the animal body:

दोषधातुमलमूलं हि शरीरम् ।

The individual properties of the Tridoshas will be described in the next chapter. However, their functions may be described here briefly. Vayu is regulative वियोजक, उत्सर्जक Pitta is catabolic and thermogenetic विभाजक, पाचक; and Kapha is anabolic and thermotaxic संयोजक, संग्राहक.

The Theory of Tridoshas is also explanatory of the differences in the temperaments of individuals and also of their diathesis in respect of age, sex, occupation, food and drink. The theory of diathesis as originating from heritage is acceptable even to modern physiologists. We, therefore, give below an extract from the able lectures of Professor J. Milner Fothergill, M. D., of London:

"Five such forms of diathesis are described: (1) Strumous, (2) Gouty, (3) Nervous, (4) Bilious and (5) Lymphatic. Each constitution carries with it certain tendencies of particular importance. In each there is a distinct inclination to institute certain symptoms. The strumous are lacking in vital force. The gouty are very liable to ailments in advance

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life, especially those due to imperfect elimination of nitrogenous waste. In the nervous, there is a distinct leaning towards complicated diseases connected with the nervous system. The bilious are always more or less troubled with the accumulation of bile-products in their portal circulation. In those of the lymphatic diathesis there is always a feebleness of resisting power. Among personal characteristics too is the possession of endurance. In one system repeated attacks of disease may have shaken it to its very foundations; in another, repeated perturbations seem to have educated the system to seek a new equilibrium under disquieting circumstances and this education enables it to recover from rude oscillations. There is also the greatest possible difference in individual organisms as to the amount of food, wine etc. required to compass a certain effect. or to evolve a given amount of manifested energy."

CHARAKA and SUSHRUTA also mention the diathesis as explained in the above quotation. (Vide Charaka, Sootrasthana, Ch. VII and SUSHRUTA, Sootrasthana, Ch. XV).

The Tridosha Theory is, again, suggestive of the influence on the individuals, of the time of the day, season of the year and climate. WAGBHATA says, "वयोऽहोरात्रिभुक्तानां तेऽन्तमध्यादिगाः क्रमात्"

—वा. सू. अं. १

In the case of occupations, habits, food, drink and sleep, the differences in the constitutions are dependent upon the individual characteristics and circumstances. Heredity, again, has its influence in shaping the constitution, as वातल, पित्तल and श्लेष्मल.

Both CHARAKA and SUSHRUTA say:

समपित्तानिलकफाः केचिद्गर्भादिमानवाः ।
दृश्यन्ते वातलाः केचित्पित्तलाः श्लेष्मलास्तथा ॥३९॥

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तेषामनातुराः पूर्वे, वातलाद्याः सदाऽऽतुराः ।
दोषानुशायिता ह्येषां देहप्रकृतिरुच्यते ॥४०॥

—च. सू. अ. ७

In respect of habits and idiosyncrasies SUSHRUTA says,

सात्म्यतोल्पतया वापि दीप्ताग्नेस्तरुणस्य च ।
स्निग्धव्यायामबलिनां विरुध्दं वितथं भवेत् ॥
व्यायामशीलो बलवान् शिशुश्च ।
स्निग्धोऽग्निमांश्चापि महाशनश्च ॥
आप्नोतिरोगान्नविरुद्ध जातान् ।
अभ्यासतो वाल्पतया च जंतुः ॥

—सु. सू. अ २१

For the sake of illustration these factors are arranged in the form of a table given on the next page.

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TABLE NO. 5

Showing the relations between त्रिदोषs and age, part of the body, Meal, Day, Night aud Season.

Constitótion	Age	Part of Body (कोष्ठ)	Meals	Day	Night	Season
वात	Oldage	Lower Part	अन्ते	After noon	Last portion of Night	ग्रीष्मे ———— संचय वर्षासु प्रकोप शरदि उपशम
पित्त	Youth	Midde part	मध्ये	Mid day	Mid night	वर्षासु ———— संचय शरदि ———— प्रकोप हेमंते ———— उपशम
कफ	Infancy and child hood	upper part	आदौ	Morning	First part Night	शिशिरे ———— संचय वसंते ———— प्रकोप ग्रीष्मे ———— उपशम

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CHAPTER III

PRASANNA-DHATU AND MALA-DHATUS

We shall now proceed to the consideration of the Dhatu-group which bears some special characteristics differing from those of the Tridosh Group. The characteristics are: 1. संस्थानकृत्त्वम् – The property of affording shape, structure and fineness to the body. (This applies to दूष्यधातुs). 2. सतत परिणामशीलत्वम्– Tendency to undergo transformation during the working processes of the body. 3. स्वस्रोतोनुचरत्वम्.— The behaviour of being confined within their respective स्रोतs.

Before entering into the subjects of the SAPTA-Dhatus it is necessary to know what Prasanna-Dhatus and Mala-Dhatus are and why they are made to bear a common appellation 'DHATU'.

The human body is composed of thirteen constituents which are divided into three groups: (a) DOSHAS, (b) DHATUS and (c) MALAS. The Doshas are three, the Dhatus seven and the Malas three in number. Sushruta says "दोषधातुमलमूलं हि शरीरम्" When normally disposed, the Dhatus are in their Prasanna (Pure) state ; and when abnormally disposed, they are in their Mala form-impure form. It must here be noted that the word "Mala" मल has two or three significations: e. g.,

1. आहारमलत्वाच्च मलाः। अष्टांग संग्रह; किट्टमन्नस्य विण्मूत्रम् ।
—च. चि. अ. १५

2. देहस्य मलिनीकरणात् मलाः । अष्टांग संग्रह.

3. शरीरधातवः पुनर्द्विधाः संग्रहेण मलभूताः प्रसादभूताश्च ।
—च. शा. अ. ६।१७

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In the first statement the word 'Mala' means 'faecal matter and urine' which deserve only to be excreted.

In the second it means 'toxins' (बाधकर) bodies which if retained, cause harm to the system.

And in the third it means-bears reference to the processes going on in धातु—उपचय i. e. formation of Dhatus from a developmental point of view. The Malabhutas mentioned here are in connection with शरीरधातवः and are not आहारमलाः as signified in the first two cases. Regarding the last statement CHARAKA says,

प्रसादकिट्टे धातूनां पाकादेवंविधः स्मृतः ॥
परस्परोपसंस्तम्भा धातुस्नेहपरंपरा ॥३१॥

—च. चि. अ. १५

The first line suggests that by certain chemical processes in the metabolism प्रसाद and किट्ट Dhatus are formed. The second line is in relation to the formation of the seven देहधारक Dhatus. In this phase Malas are described as body-sustainers in a special sense and are termed "Kitta-dhatus". CHARAKA says, धातवो हि धात्वाहाराः प्रकृतिमनुवर्तन्ते । तत्राहारप्रसादाख्यो रसः किट्टं च मलाख्यमभिनिर्वर्तते । किट्टात्स्वेदमूत्रपूरीषवातपित्तश्लेष्माणः कर्णाक्षिनासिकास्यलोमकूपप्रजननमलाः केशश्मश्रुलोमनखादयाश्चावयवाः पुष्यन्ति । पुष्यन्ति ह्याहाररसात् रसरुधिरमांसमेदोऽस्थिमज्जशुक्रौजांसि पंचेंद्रियद्रव्याणि धातुप्रसादसंज्ञकानि शरीरसन्धिबन्धपिच्छादयश्चावयवाः ॥

—च. सूत्रस्थान. अ. २८।३.

In continuation of the same strain he adds ते सर्वे एव धातवो मलाख्याः प्रसादाख्याश्च रसमलाभ्यां पुष्यन्तः स्वं मानमनुवर्तन्ते यथावयः

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शरीरम् । एवं रसमलौ स्वप्रमाणावस्थितौ आश्रयस्य समधातोर्धातुसाम्यमनुवर्तयतः ॥३॥

—च. सू. अ. २८।३

In support of the statement that Malas are also useful in regulating the metabolism, SUSHRUTA says,

पूरीषमुपस्तंभं वाय्वग्निधारणं च । बस्तिपूरणविक्लेदकृन्मूत्रं । स्वेदः क्लेदत्वक्सौकुमार्यकृत् ॥

—सु. सू अ. १५

The sum and substance of these quotations is this:

(a) Harmful products such as mucous, sweat, phlegm or pus, (b) Wata, Pitta and Kapha doshas in their vitiated condition, and (c) any other substance which becomes injurious to the body are all Malabhoota dhatus; and all others, viz., the Tridoshas in their pure state, the seven dhatus, and Up-dhatus like आर्तव and स्तन्य are प्रसन्नभूत dhatus. (Vide CHARAKA, Shareerasthana, Ch. 6). When the term 'Malas' is used in the sense of Kitta-dhatus it is not to be supposed that they are entirely useless, for they have a function to serve in the body economy, and that is to nourish स्वेद, मूत्र and पुरीष— the excretions of the ear, the eye, the nose, the mouth and the hair-follicles as referred to in the quotation from CHARAKA (Sootra-sthana). So these Malas, when excreted in due proportion, with the exclusion of all excess or deficit (न्यूनातिरेक) serve as supporters of the metabolism in one way. They perform only a secondary action and that is maintaining economy in the body. In short, all the tissues (dhatus) are constantly undergoing alternate anabolism and catabolism. These constructive and destructive processes in metabolism are physiological and pathological like the क्षय and वृद्धि of the dhatus. These vital processes go by the name of उपचय

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(Anabolism) and अपचय (Catabolism). Regarding the complex mechanism which subserves nutrition, Dr. Laumonier says, "As a matter of fact, assimilation does not imply the indiscriminate absorption of all the materials which are accessible; only certain definite chemical combinations of the molecular structure of nutritive matters are made use of, the remainder being rejected. These accessory products of assimilation are partly soluble and partly insoluble. The latter are deposited in the locality in which they take their origin, and are represented by keratin, chondrin, ossein, cartilaginin, elastin etc., all of which are employed in building up the tissues..... The accessory soluble matters, conjointly with the results of fermentative decomposition, of complete oxidation, of the destruction and degeneration of tissues which are in a state of functional repose, represent the waste products of functional activity."

SAPTA-DHATUS: THE SEVEN DHATUS.

These constitute the supporting structures of the body. They are:

1. रस -Rasa ..... the primary product of food-digestion.
2. रक्त -Rakta ..... blood.
3. मांस -Mansa ..... flesh -muscles and tendons.
4. मेदस् -Medas ..... fat.
5. अस्थिन् -Asthin ..... bone.
6. मज्जन् -Majjan ..... bone-marrow.
7. शुक्रम् -Shukram ..... vital fiuid.

These are called 'dnshya' —दूष्य —also as they are liable to be vitiated by the tridoshas in their pathogenic state. They represent, to some extent, the connective and nervous tissues of modern physiology. In them are to be found the tridoshas in their normal gross forms. They are said to inherit also the gunas of the Panch-mahabhutas. The following quotation from Dalhana's commentary supports this statement:

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यद्यपि पंचभूतानां वाच्यः पाको द्विधा पुनः ।
तथाप्यपां प्रधानत्वाद्रसः सौम्योऽभिधीयते ॥
अतिरिक्ता गुणा रक्ते वन्हेर्मांसे तु पार्थिवाः ।
मेदस्यम्बुभुवोरस्थि पृथिव्यनिलतेजसाम् ॥
मज्जि शुक्रे वा सौम्यस्य मूत्रेऽम्बुशिखिनोर्गुणा ।
भुवो विश्यार्तवे त्वग्नेः प्रस्वेदस्तन्ययोरपाम् ॥
इति धातुमलेषूक्ता गुणाः प्राधान्यतः स्थिताः ।
प्रायेण भूगुणा गर्भे स्तोकाद्यनुग्रहा इति ॥४॥

—सु. सू. अ. १५ डल्हण टीका

The Functions of the Sapta-dhatus: The functions of the Sapta-dhatus in their normal condition are as follows: (Vide Sushruta, Sutrasthana Ch. 15, Art. 5).

1. Rasa gives a feeling of satisfaction (प्रीणन) and promotes the formation of blood.

2. Rakta -is enlivening or life-giving (जीवन); contributes to a healthy complexion (वर्णप्रसादन) and leads to the formation of मांसधातु

3. Mansa - contributes to the fulness (nourishment) of the body (शरीरपुष्टि) and produces Medas.

4. Medas -gives oiliness and warmth to the body (Snehana), imparts firmness and stability to the bones and helps their growth.

5. Asthin -supports the body (धारण) and promotes the formation of Majjan.

6. Majjan -fills up the interior portions of bones (पूरण), gives strength to the body, creates affection and attachment, and nourishes Shukram.

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7. Shukram -accomplishes the purpose of emission, bestows courage and strength, creates attraction for the opposite sex and pleasure in their company, and is responsible for concetpion and reproduction (गर्भोत्पादन).

Note: ओजस् is the quintessence of all the dhatus. Its main seat is the heart (हृदय), though it is true that it permeates and pervades the whole body.

Its properties and functions are described as:

ओजः सोमातत्मकं स्निग्धं शुक्लं शीतं स्थिरं सरम् ।
विविक्तं मृदु मृत्स्नं च प्राणायतनमुत्तमम् ॥२५॥
देहस्यावयवस्तेन व्याप्तो भवति देहिनाम् ।
तदभावाच्च शीर्यन्ते शरीराणि शरीरिणाम् ॥२६॥

—च. सू. अ. १५

It is responsible for the maintenance and upkeep of the body. When it perishes the body is invariably destroyed, and life exists so long as it exists; the various activities, functions and features of the system are entirely dependent on it.

Nourishment of the Sapta-Dhatus by Ahara-rasa:

Rasa —'त्रिधातुसमुदायात्मक आहाररसः':— is the essence of the food ingested and digested properly. It circulates in all the parts of the body through the lymphatics and the blood-vessels, nourishes and supports them and helps their development. Its situation is the heart. Because, it comes back to the heart after being driven from it to all the parts, and playing its part in the nutritional functions. It is Pancha-bhautika in character as it is the essence of Ahara-dravyas. SUSHRUTA says,

पंचभूतात्मके देहे आहारः पांचभौतिकः ।
विपक्वः पंचधा सम्यग्गुणान् स्वानभिवर्धयेत् ॥५२४॥

—सु. सू. अ. ४६

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It is endowed with potential heat obtained during the digestive processes. So, it imparts its Pancha-bhautika character to all the seven dhatus. It is, therefore, called पोषकरस, a name distinguished from पोष्यरस applied to the आद्यधातु, the first of the seven dhatus. SUSHRUTA and CHARAKA support this view in the following words:

.....सारः प्रागीरितो रसः ।
स तु व्यानेन विक्षिप्तः सर्वान् धातून् प्रतर्पयेत् ॥५२६॥
—सु. सू. अ. ४६

व्यानेन रसधातुर्हि विक्षेपोचितकर्मणा ।
युगपत् सर्वतोऽजस्रं देहे विक्षिप्यते सदा ॥३५॥
—च. चि. अ. १५

It can very well be inferred from these quotations that Rasa-dhatu plays the same part in Circulation as the blood in modern Physiology. The nerves which impel the circulation are contained in Vyana-vayu which is supplied to all the parts of the body and is also closely connected with vaso-motor system.

Production of the Seven Dhatus and the part played by Agni in the process:

In this connection SUSHRUTA says,

स खलु आप्यो रसो यकृत्प्लीहानौ प्राप्य रागमुपैति ॥४॥
रंजितास्तेजसा त्वापः शरीरस्थेन देहिनाम् ।
अव्यापन्नाः प्रसन्नेन रक्तमित्यभिधीयते ॥
रसाद्रक्तं ततो मांसं मांसान्मेदः प्रजायते ।
मेदसोऽस्थि ततो मज्जा मज्ज्ञः शुक्रं तु जायते ॥१०॥
—सु. सू. अ. १४

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The sum and substance of these verses is that Anna-rasa (अन्नरस) gives nourishing material to the tissues, both directly and indirectly. The direct method is the one explained by the general statement "सर्वदा सर्वभावानाम् सामान्यं वृद्धिकारणम्." The indirect nourishment is conducted stage by stage through the processes of analysis and synthesis in dhatu-formation. The Pancha-bhautika Ahara consisting of the Shad-rasas nourishes the Tri-dhatus. Then the Tri-dhatus nourish the Sapta-dhatus. The Adya-dhatu-rasa (आद्यधातुरस) requires to be enriched with pigment before it is converted into blood. It gets its share of pigment-haemoglobin-from the liver and the spleen, when it passes through them. This hæmoglobin is a by-product of 'ferratin'-an iron containing body stored up in the liver,. Further, as the process of development goes on, Mansa (मांस) is nourished by Rakta (रक्त), Medas (मेदस्) by Mansa, Asthin (अस्थिन्) by Medas, Majjan (मज्जन्) by Asthin, and Shukram (शुक्रम्) by Majjan. These processes are brought about chiefly by Agni. CHARAKA says,

यदन्नं देहधात्वोजोबलवर्णादि पोषकम्।
तत्राग्निर्हेतुराहारान्न ह्यपक्वाद्रसादयः ॥ ४ ॥

—च. चि. अ. १५

Translatiou:—The nutritional value of food which nourishes the body, its tissues, vital essence ओजस्, strength, complexion etc. is mainly dependent on Agni; because Rasa and other dhatus cannot develop from undigested food.

Agni in the form of Pitta-dhatu is present everywhere in the body and in consequence of this a constant process of 'digestion' is going on in every part of the body. Agni implied here is both of a potential as well as of a kinetic type. In this connection the Ayurvedists have mentioned thirteen kinds of Agni. They are

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(1) The seven धात्वग्निs—Agnis existing in the Sapta-dhatus and their सूक्ष्मावयवs, the cells.

(2) The five भूताग्निs—which belong to the panchamaha-bhutas.

(3) जाठराग्नि —the heat produced in the digestive processes in the gastro-intestinal tract.

Of these agnis, the one with the gastro-intestinal origin is the most important. For, upon the variations of this digestive heat depend the वृद्धि and क्षय of both भूताग्नि and धात्वग्नि. (Vide verses 36 and 37, Chikitsasthana, CH. 15, Charaka). This heat breaks up the compactness of food and reduces it, by analysis into similar substances. CHARAKA clearly says,

भौमाप्याग्नेयवायव्याः पंचोष्माणः सनाभसाः ।
पंचाहारगुणन्स्वान्स्वान्पार्थिवादीन्पचन्ति हि ॥१२॥
यथास्वैरेव पुष्यन्ति देहे द्रव्यगुणाः पृथक् ।
पार्थिवाः पार्थिवानेव शेषाः शेषांश्च कृत्स्नशः ॥१३॥

—च. चि. अ. १५

Explanation: Then, the five agnis belonging to the five elements operate upon the five elemental portions of Ahara--dravya (आहारद्रव्य) with the result that शब्द, स्पर्श, रूप, रस and गन्ध are exhibited in the body--tissues. As the gunas of the Panchabhautas are transferred to Sapta--dhatus, the धात्वग्निs belonging to the latter behave in a similar way. In this way the Panchabhautika properties शब्दादिगुण of food nourish the corresponding Panchabhautika properties of the body-content.

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Analysis and Synthesis in Dhatu-formatio:n—

WHEN the Sapta-dhatus are being thus nonrished, each with its own agni, certain processes of analysis and synthesis take place in their constituents. Each of these seven dhatus is broken up into three sets of products. Shukra, the last one, is an exception as it has no Mala in a healthy condition. One of these sets (by-products) contributes to the growth of the स्थायीधातु, the second —सूक्ष्म— contributes to the next tissue (dhatu) in order and the third takes part in the Mala-dha tu. This is expressed in the following lines:

स्थूलसूक्ष्ममलैः सर्वे भिद्यन्ते धातवस्त्रिधा ।
स्वः स्थूलोंऽशः परं सूक्ष्मस्तन्मलं याति तन्मलः ॥
स्वाग्निभिः पच्यमानेषु मलः षट्सु रसादिषु ।
न शुक्रे पच्यमानेऽपि हेमनीवाक्षये मलः ॥

—सु. सू. अ. १४।१० डल्हणटीका

The Malas of the different dhatus produced after digestion (action and reaction), referred to above, are

किट्टमन्नस्य विण्मूत्रं रसस्य तु कफोऽस्रजः ॥२९॥
पित्तं मांसस्य च मलो मलः स्वेदस्तु मेदसः ।
स्यात्किट्टं केशलोमाऽस्थ्नो मज्जः स्नेहोऽक्षिविट् त्वचाम् ॥
प्रसादकिट्टे धातूनां पाकादेवंविधःस्मृतः ।
परस्परोपसंस्तंभाधातुस्नेहपरंपरा ॥३०॥

—च. चि. अ. १५

In the last line the poet--philosopher says, "Such is the force of heredity manifested in the adjustment of stability and mutual co--operation among the tissue--elements by a process of interaction." These views of the Ayurvedic writers regarding the developmental proclivities of the tissues and their elementary parts point out clearly that the conception

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entertained by them is not imaginary. The interdependence of the tissue-elements exhibited in the maintenance of the balance of life through the influence of their by--products प्रसादाख्य or मलाख्य suggests that the supersensory (अतीन्द्रिय) processes are conducted through a mechanism other than the Central Nervous system. This mechanism is nothing but the influence of the Tridoshas in their subtle state, actuated by the intrinsic faculties of अध्यात्मगुणसंग्रह Cf. CHARAKA's following words:

शरीरावयवास्तु परिमाणुभेदेनापरिसंख्येया भवन्त्यतिबहुत्वादतिसौक्ष्म्यादतीन्द्रियत्वाच्च; तेषां संयोगविभागे परमाणूनां कारणं वायुः कर्म स्वभावश्च ॥ १६ ॥ —च. शा. अ. ७

It cannot be denied that there is, in health, a sort of organic equilibrium between cellular elements of the different tissues and the products of their secretion. It may, therefore, be concluded that the alterations which affect certain elementary cells in the body always react on the corresponding anatomical elements, and modify the constitution of their structure.

The interchange of matter secreted by these cellular groups is more intrinsic and contribntes to the primary stages of development in organic evolution. The line 'स्वस्थूलोंऽशः परं सूक्ष्मस्तन्मलं याति तन्मलः' goes to show how the nourishment of different tissues रसः, रक्त, मांस, मेदस्, अस्थिन्, मज्जन् and शुक्र is maintained in a certain order of progression from Rasa onwards, each सूक्ष्म portion influencing the structure of the next dhatu in the course of development. The order of succession in the developmental process indicates how complex bodies are formed from simple ones, how the interchange of internal secretions (not necessarily endocrines) pertaining to the cellular groups become thicker as development proceeds, and how nature, irrespective of any definite propensities, adapts itself to conditions in the development of the organism.

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These statements can be verified by some pathological facts, e. g. if Madhura-rasa (मधुररस), which is consumed with the food, is larger in proportion than the quantity required Medas-dhatu is developed. In this connection SUSHRUTA says, रसनिमित्तमेव स्थौल्यं कार्श्यं च। तत्र श्लेष्मलाहारसेविनोऽव्यशनशीलस्य अव्यायामिनो दिवास्वप्नरतस्य च आम एव अन्नरसो मधुरतरश्च शरीरमनुक्रमन् अतिस्नेहान् मेदोजनमयति, तदतिस्थौल्यमाप्मदयति; ॥३८॥

—सु. सू. अ. १५

Growth, in fact, is an exceedingly complex process due to multitudinous factors, and we cannot give priority in importance to one over the other, as all of them are working in cooperation with one another.

Relation between Dhatus and Organs: This relation is more to be judged than examined in the light of modern anatomy. Ayurvedists have made mention of all the organs in their treatises but as their etiology, pathology and principles of treatment are based upon Tridosha-Siddhanta, there has been no occasion to give detailed descriptions of morbid anatomy of the organs in disease. The occidental and oriental descriptions, so, vary on account of the fundamental differences in the view-points regarding the creation of the human body. The westerners apeak of the body as consisting of matter, while the Ayurvedists speak of it as consisting of matter and Chaitanya (चैतन्य). Hence the latter describe the body as षड्धातुs. For practical purposes in treatment, they have amplified this description nnd mentioned प्रत्यंगs and अवयवs. In this connection the reader is referred to अष्टोदरीय and महारोग अध्यायs in CHARAKA's सूत्रस्थान. In the latter chapter CHARAKA says, विकाराः पुनरपरिसंख्येयाः प्रकृत्यधिष्ठानलिंगायतनविकल्पविशेषात् तेषामपरिसंख्येयत्वात्।

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Here the words अधिष्ठान and आयतन are used in the sense in which the word 'organ' is used in modern language. So the place of 'organs' in Ayurvedic Anatomy may be located somewhere between dhatus and malayantaas (मलायतनs)

Further, the inter-relation between dhatus and organs can be well illustrated by taking examples wherein disease of the organ (locality) follows the disease of the tissue concerned. For example,

रसक्षये हृत्पीडाकम्पशोषशून्यतास्तृष्णा च। शोणितक्षये त्वक्पारुष्यं, मांसक्षये उदरग्रीवाशुष्कता, मेदः क्षये सन्धिशून्यता, अस्थिक्षये अस्थिशूलं, मज्जक्षये अस्थिशून्यता, शुक्रक्षये मेढ्रवृषणवेदना ॥१३॥

—सु. सू. अ. १५

Similarly CHARAKA's words in explaining the cause of pulmonary tuberculosis afford another example, he says,

यथास्वेनोष्मणा पाकं शारीरां यान्ति धातवः।
स्रोतसा च यथास्वेन धातुः पुष्यति धातुना ॥३७॥
स्रोतसां संनिरोधाच्च रक्तादीनां च संक्षयात्।
धातूष्मणां चापचयाद्राजयक्ष्मा प्रवर्तते ॥३८॥

—च. चि अ. ८

Now, how Rasa-dhatu stands in relation to the development of Garbha is described by CHARAKA as follows: रसजश्चायं गर्भः; न हि रसादृते मातुः प्राणयात्राऽपि स्यात्, किं पुनर्गर्भजन्म, न चैवमसम्यगुपयुज्यमाना रसा गर्भमभिनिर्वर्तयन्ति। न च केवलं सम्यगुपयोगादेव रसानां गर्भाभिनिर्वृत्तिर्भवति, समुदयोऽप्यत्र कारणमुच्यते। यानि तु खल्वस्य गर्भस्य रसजानि, यानि चास्य रसतः संभवतः संभवन्ति, तान्यनुव्याख्यास्यामः —तद्यथा— शरीरस्याभिनिर्वृत्तिरभिवृद्धिः प्राणानुबन्धस्तृप्तिः पुष्टिरुत्साहश्चेति रसजानि ॥१८॥

—च. शा. अ. ३.

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Translation. Rasa is necessary for the development of Garbha, for it is impossible for the mother to sustain her life without proper Ahara-rasa, then what of the foetus. The rasa, if not in a healthy state, is unable to nourish the foetus. Even though it be so, the रसोत्पादन alone, unaided by other factors such as good diet, religious life etc. on the part of the mother is not able to produce a wellformed foetus.

The salutary effects of healthy Rasa, produced in the offspring, will be stated hereafter. They are : a body with well-developed limbs, proper growth, strength, tranquility, nutrition and energy.

Regarding the hereditary influences which bear upon the moulding of the foetus, CHARAKA writes.

गर्भस्य चत्वारि चतुर्विधानि भूतानि मातापितृसम्भवानि ।
आहारजान्यात्मकृतानि चैव सर्वस्य सर्वाणि भवन्ति देहे ॥२६॥
तेषांविशेषाद्बलवन्ति यानि भवन्ति मातापितृकर्मजानि ।
तानि व्यवस्येत्सदृशत्वलिंगम् सत्वं यथानूकमपि व्यवस्येत् ॥२७॥
—च. शा. अ. २

Translation: There are four important factors which contribute to the production of Garbha. They are (i) the Mahabhutas, (2—3) the properties belonging to the tissues (dhatus) of the father and the mother begotten by good diet, and (4) the results of the actions (Karma) of past lives. Of these, the dhatus of the mother and the father, शोणित and शुक्र are more important because they impart the likeness of the parents to the offspring. Regarding the disposition of the mind, there is no other cause but Praktana (प्राक्तन) and former birth. In these verses CHARAKA refers to the origin of the body from sources such as (1) the five Mahabhutas, (2) the condition of the parents, (3) the effects of the food which the

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parents consume, and (4) the influences of the past-previous life. He further refers to the mental character of the individual as being evolved from Praktana, actions of the past life.

In consideration of all the factors related to the development of the Garbha, it is no wonder if CHARAKA defines 'life' —'आयुः' as

शरीरेन्द्रिय सत्वात्मा संयोगो धारिजीवितम् ।
नित्यगश्चानुबंधश्च पर्यायैरायुरुच्यते ॥

Translation: Life is an aggregation of the body, the sense-organs, the mind and the soul. It supports the body and the pranas. It is spoken of as 'आयुस्' because it wears off every day and bears connection with the past and further lives.

The idea carried in this verse exactly coincides with that expressed by KAPILADEVA in his Theory of Evolution. CHARAKA has adopted the same theory and based the superstructure of the human body on the twenty-five principles mentioned in the last section. In Shareera-sthana the 'body' is defined as शरीरं नाम चेतनाधिष्ठानभूतं पंचभूतविकारसमुदायात्मकम् ॥४॥

—च. शा. अ. ६

Translation: The living body is a receptacle of the modifications of the five elements, supported by Atman the soul.

The modifications suggested by the word 'विकार' are clearly expressive of the fact that the Pancha-bhutas enter into the constitution of the human body, along with Atman and assume the altered forms of Vata, Pitta and Kapha.

Now, though the Tridoshas are the primal factors from a morphological point of view, they require for support (in their Sthoola form) certain fixed tissues of the body through which

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they can perform their functions. These fixed tissues are undoubtedly the Sapta-dhatus as already stated. Out of these, 'blood' Rasa-dhatu is the most important as it supports the other body-tissues and enables them to perform their respective functions. SUSHRUTA adimits this frankly as stated in the beginning of this section. (Vide Ch. 21, Sutra-sthana). In order to emphasize the real value of blood, he further says that blood is life itself:

देहस्य रुधिरं मूलं रुधिरेणैव धार्यते ।
तस्माद्यत्नेन संरक्ष्यं रक्तं जीव इति स्थितिः ॥४५॥

—सु. सू अ. १४

Even if it is so, he assigns to blood a second place in the constitution of the body, and says that the very composition of blood, in a healthy condition, depends on the Tridoshas:

यस्माद्रक्तं विना दोषैर्न कदाचित् प्रकुप्यति ।
तस्मात् तस्य यथादोषं कालं विद्यात् प्रकोपणे ॥२६॥

—सु. सू. अ. २१

Again, he reiterates that blood-vessels are in one way the channels for conducting the Tridoshas to the different parts of the body.

न हि वातं शिराः काश्चित् न पित्तं केवलं तथा ।
श्लेष्माणं वा वहन्त्येता अतः सर्ववहाः स्मृताः ॥१६॥

—सु. सू. अ. ७

उपधातुs-UPA-DHATUS.

Upa-dhatus are also parts of the body which take part in its construction. But they do not take part in the general metabolism and have not the power to develop the principal constituents (Tri-doshas) from the Pancha-bhautika portions parts-of the food which we take everyday, in order to make

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up for the waste which is occuring everyday, every moment in the body. They are skin, muscle, tendon, blood-vessels etc. They do not go to form any other substance in the body but are only ultimate products. In the causation of disease it is the dhatus which are affected and not the upa-dhatus. If the disease-process continues, the upa-dhatus are also affected but not so in the initial stage.

MALAS:

Malas are three, viz., Mala (मल), Mootra (मूत्र) and Sweda (स्वेद) meaniug respectively 'faecal excretion', urine' and 'sweat'.

The term 'मल', in general, comprises body-principles which become unfit for being utilised for the building of the body, or those which are harmful to it and so deserve to be got rid of.

A description of what the 'Excretary Malas' are and how the special form of 'Kitta' (किट्ट) supports and nourishes the malas and thus maintains the body-integrity, is already given under 'Prasanna-dhatus and Mala-dhatus'. The malas of the Sapta-dhatus referred to there are:

DHATU:- **Instances of Mala**

1. Rasa -Kapha, mucoid secretion from the tongue, the buccal mucous membranes and gastro-intestinal tract.

2. Rakta -Pitta in its gross form, e. g., रक्तपित्त.

3. Mansa -Secretions of the ear, viz., the wax; and of the nose.

4. Medas -Sweat, and the excrementitious matter from the axilla and the prepuce.

5. Asthin -Nails and hair.

6. Majjan -Secretions of the eye and the skin, the oily portions of faeces.

7. Shukram -No mala.

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THE FUNCTIONS OF THE THREE 'MALAS'.

(1) PURISHAM (पुरीषम्) In some sense, it supports the body; it holds VAYU (वायु) and AGNI (अग्नि) and thus maintains the activity of the region in which it is situated.

CHAKRAPANI (चक्रपाणि) explains this as — 'सर्व-धातुक्षयार्तस्य बलं तस्य हि विट्बलम्". He means to say Purisha formax a support to him who has all his tissues drained away (divested of their tone) by some chronic disease.

(2) MOOTRAM (मूत्र). It fills the bladder, and caries the effete watery material out of the system.

(3) SVEDA. (स्वेद). It keeps the skin moist and maintains its natural lustre.

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CHAPTER IV

THE TRIDOSHAS.

The Tridoshas-VATA, PITTA and KAPHA-Etymology and Situations:

ETYMOLOGY :

The etymology of Vata-Pitta and Kapha indicates their respective properties and actions clearly. The denomination of the three doshas is based on their root-meaning. This can be known from the details given by SUSHRUTA.

The word' वायु ' is derived form the root ' वा ' which is expressive of two meanings, viz., गति and गंधन (वा=गतिगन्धयो). Vayu, therefore, indicates (1) movement, adjusment, and (2) conduction of gandha particles-odour. Rajo-guna (रजोगुण) is predominant in this principle.

The word 'पित्त' is derived from the word ' तप् ', and so is expressive of संताप, a result of आग्नेयगुण

The word 'श्लेष्मन्' is derived from 'श्लिष' to embrace. The root meaning, therefore indicates 'attachment and assimilation '. श्लेष्मा has आप्यगुणs

Thus we see that these names are given to the three chief principles, the Tridoshas; no distinction has been made between the property (आश्रयी) and the subject (आश्रय). Hemadri· the commentator of Ashtanga-hridaya makes this sufficiently elear in the following words:

एवं तद्गुणयोगात् गुणगुणिनोः अभेदोपचारात् वातादयः गुणतः निर्दिष्टाः

It will now be seen that though the Tridoshas are primarily taken to mean elementary principles, they are virtually material entities as recognised from their gunas and karmas. They have द्रव्यत्व as their base on the strength of which they have the

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capacity to regulate the system. Their names rightly indicate their physical and physiological properties. So, when the word 'वायु' is used, it should be taken to mean a dravya invested with gunas and karmas.

REGIONS OF VATA, PITTA AND KPAHA.

The particular localities in which, by a process of selection and adaptation, the three doshas are situated for purposes of physiological functions, are stated below ;

Regions of Yayu.

पक्वाशयकटीसक्थिश्रोत्रास्थिस्पर्शनेंद्रियम् ।
स्थानं वातस्य, तत्रापि पक्वाधानं विशेषतः ॥ १ ॥
— अ. हृ. अ. १२

Translation: The large intestines, the waist, the thighs, the ears, the bone and the skin ; out of these, the large intestines form the chief seat.

Regions of Pitta:

नाभिरामाशयः स्वेदो लसीका रुधिरं रसः ।
दृक् स्पर्शनं च पित्तस्य, नाभिरत्र विशेषतः ॥ २ ॥
—अ. हृ. अ. १२

Translation: The portion of the nowel behind the navel, the Amashaya (the stomach and the small intestines), sweat, Laseeka—watery discharges from the surface of the soft tissues and membranes, the blood, Rasa-dhatu, the eyes and the skin. Out of these, the portion behind the umbilicus (पक्वामाशयमध्य) is the chief seat.

Regions of Kapha:

उरःकंठशिरःक्लोमपर्वाण्यामाशयो रसः ।
मेदो घ्राणं च जिव्हा च कफस्य सुतरामुरः ॥ ३ ॥
— अ. हृ. अ. १२

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Translation: The chest, the throat, the head, the oesophagus (Kloma), the joints, Amashaya (the stomach), Rasadhatu, fat, the nose and the tongue. Of these, the chest is the chief seat.

Explanation: Vayu: It appears that there are therapeutical reasons to point out why पक्वाशय (the colon) is considered to be the chief seat of Vayu. Enemas are stated to be the chief agents for relieving the derangement of Vayu in the Gastro-intestinal tract. When the वृध्दवायु is removed by enema the स्रोतोऽवरोध (tension) caused in the other parts of the body is relieved, and so there is return to health.

Cf. बस्तिविरेको वमनं in वातपित्तकफ चिकित्सा ।

Pittam: CHARAKA describes Amashaya as the chief seat of Pitta, whereas SUSHRUTA makes पक्वामाशयमध्य - the small intestines the chief seat of Pitta. There is no doubt that Pachaka, pitta which is situated between the stomach and the colon, is the chief पित्तोष्मा which digests food and is also responsible for the production of all agnis. It is, therefore, better to take the small intestines as the chief seat of Pitta. Amashaya is the seat of Kledaka-kapha, as mentioned by all writers. But if CHARAKA's definition is taken, there would then be no discrepancy; Charaka says,

नाभिस्तनान्तरं जन्तोरामाशय इति स्मृतः

Kapha: The chest is the chief seat of Avalambaka-Kapha. As this variety of Kapha supplies body-water to all the other seats of Kapha, it is but natural that the chest should be mentioned as the chief seat of Kapha.

Thus it will be seen that these 'Sthanas' rightly indicate where the Tridoshas work in their grosser forms. The localities in which they exhibit their specific actions are also mentioned. There is some purpose, some propriety in mentioning these special regions against everyone of these three doshas.

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PHYSICAL AND PHYSIOLOGICAL PROPERTIES AND PATHOLOGICAL SYMTOMS OF TRIDOSHAS.

I. YAYU :

(a) Physical Properties:

रूक्षः शीतो लघुः सूक्ष्मश्चलोऽथ विशदः खरः ।
वीपरीतगुणैर्द्रव्यैर्मारुतः संप्रशाम्यति ॥ ५८ ॥

— च. सू. अ. १

Translation: Vayu is drying, cooling, light, penetrating, mobile, transparent (clear) and rough. When it is acted upon by dravyas of opposite qualities, it abates.

(b) Physiological Actions:

उत्साहोच्छ्वासनिःश्वासचेष्टा धातुगतिः समा ।
समो मोक्षो गतिमतां वायो कर्माऽविकारजम् ॥५५॥

—च सू. अ. १८

Translation: Energy, inspiration, expiration, movement (of all sorts regulation of Sapta-dhatus by keeping them in equilibrium, regular evacuation of the excretary channels of the body—these are the actions of the normal Vayu.

(c) Pathological Symptoms:

स्रंसव्यासव्यधस्वापसादरुक्तोदभेदनम् ॥४९॥
सङ्गाङ्गभंगसंकोचवर्तहर्षणतर्षणम् ।
कम्पपारुष्यसौषिर्यशोषस्पन्दनवेष्टनम् ॥५०॥
स्तम्भः कषायरसता वर्णःश्यावोऽरुणोपि वा कर्माणि वायोः

—अष्टांग. हृ. अ. १२

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Translation: When Vayu is deranged, the following symptoms are noticed:

Relaxation or enervation of the limbs, irregular movements, piercing pain, anaesthesia, disfunction of the organs, neuralgic pain, throbbing pains, tearing pains, suppression of the excretions, splitting sensation of the limbs, contractions of the mus-les, पिंडितत्वम् (formation of hard mass as in the case of stools, हर्ष standing of hair on their ends), thirst, tremors, पारुष्य (roughness), formation of bone-cavities. drying or wasting, throbbing, wringing spasms, arrest of body-movements, production of) astringent taste, and shadow and dark red skin.

Compare:

अध्मान स्तंभ रौक्ष्य स्फुटन विमथन क्षोभकंप प्रतोदाः ।
कंठध्वंसावसादौ श्रमकविलपनं स्रंसशूलप्रभेदाः ॥
पारुष्यं कर्णनादो विषयपरिणतिर्भ्रंशदृष्टिप्रमोहा ।
विस्पंदोद्वृत्तनाने ग्लपनमशयनं ताडनं पीडनं च ॥
मोनान्मानौ विषादो भ्रमपरिपतनं जृंभणं रोमहर्षौ ।
विक्षेपाक्षेपशोषग्रहणशुषिरताच्छेदनं वेष्टनं च ॥
वर्णःश्यावोऽरुणो वा तृडपिच महति स्वापविश्लेषसंगा ।
विद्यात्कर्माण्यमूनि प्रकुपितमरुतः स्यात्कषायोरसश्च ॥

—मा. नि. मधुकोश टीका

(d) **Aetiological Factors in the Causation of deranged Vayu:**

तिक्तोषणकषायाल्परूक्षप्रमितभोजनैः ।
धारणोदीरणनिशाजागरात्युच्चभाषणैः ॥१४॥
क्रियातियोगभीशोकचिन्ताव्यायाममैथुनैः ।
ग्रीष्माहोरात्रिभुक्तान्ते प्रकुप्यति समीरणः ॥१५॥

—वा. भ. नि. अ. १

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Translation: Ingestion of food which is bitter, pungent, astringent, scanty (insufficient), dry, untimely and hence stale ; checking the calls of nature, or undue stimulation of the evacuating organs ; keeping late hours at night: shouting (speaking in a high-pitched tone); overwork ; dread ; grief ; worries (चिन्ता); over-exercise ; sexual indulgence ; summer; the closing hours of the day and the night, the period when digestion is completed.

II. PITTA:

(a) Physical Properties :

सस्नेहमुष्णं तीक्ष्णं च द्रवमम्लं सरं कटु ।
विपरीतगुणैः पित्तं द्रव्यैराशु प्रशाम्यति ॥ ५६ ॥

— चरक. सू. अ. १

Translation: Pitta is slightly moist, heating, sharp in action, liquid (द्रव), sour (acid in nature), capable of spreading, and pungent. It abates when it is acted upon by articles possessing opposite characters.

(b) Physiological Actions :

दर्शनं पक्तिरुष्मा च क्षुत्तृष्णा देहमार्दवम् ।
प्रभा प्रसादो मेधा च पित्तकर्माऽविकारजम् ॥५२॥

— च. सू. अ. १८

Translation: Preservation of normal eye-sight, good digestion ; production of body-heat, appetite, thirst, softness of the body, lustre, mental equanimity-ease, and intelligence-these are the actions of the normal Pitta.

(c) Pathological Symptoms when Pitta-dhatu is disturbed:

पित्तस्य दाहरागोष्मपाकिताः ॥ ५१ ॥
स्वेदः क्लेदः स्रुतिः कोथः सदनं मूर्छनं मदः ।
कुटुकाम्लौ रसौ वर्णः पाण्डुरारुणवर्जितः ॥ ५२ ॥

— वा. सू. अ. १२

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Translation: Burning sensation, redness, heat, over-action of digestive process, sweating, creation of moisture, secretion, decomposition, lowering of the function (such as that of digestion); fainting, intoxication, creation of pungent and sour taste, and all colours except white and dark-red.

Compare.

विस्फोटाम्लकधूमकाः प्रलपनं स्वेदस्रुतिर्मूर्च्छनम् ।
दौर्गंध्यं दरणं मदोविसरणं पाकोऽरतिस्तृड्भ्रमौ ॥
उष्माऽतृप्तितमःप्रवेशदहनं कट्वम्लतिक्तारसा ।
वर्णः पांडुविवर्जितःकथितता कर्माणि पित्तस्यवै ॥

— म. को. टीका. मा. नि.

(d) Aetiological Factors :

पित्तं कट्वम्लतीक्ष्णोष्णपटुक्रोधविदाहिभिः ।
शरन्मध्याह्नरात्र्यर्धविदाहसमयेषु च ॥ १६ ॥

— वा. नि. अ. १

Translation: Ingestion of food which is pungent, sour, sharp in taste, hot, saltish and irritating, anger, winter, mid-day and mid-night, and active digestion.

III. KAPHA :

(a) Physical Properties :

गुरुशीतमृदुस्निग्धमधुरस्थिरपिच्छिलाः ।
श्लेष्मणः प्रशमं यान्ति विपरीतगुणैर्गुणाः ॥६०॥

— च. सू. अ. १

Translation: Kapha-dhatu is heavy, cooling, soft, moist, sweet, steady and slimy; when it is acted upon by dravyas of opposite characters, it abates.

(b) Physiological Actions.

स्नेहो बंधः स्थिरत्वं च गौरवं वृषता बलम् ।
क्षमा धृतिरलोभश्च कफकर्माऽविकारजम् ॥५३॥

—च. सू. अ. १८

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Translation: Preservation of normal moisture, stability of joints, firmness of the body, a proportionate bulk and weight, manhood, strength, endurance, courage, absence of greed-are the actions of Kapha when it is normal.

(c) **Pathological Symptoms.**

श्लेष्मणः स्नेहकाठिन्यकण्डूशीतत्वगौरवम् ।
बन्धोपलेपस्तैमित्यशोफापक्त्यातिनिद्रताः ॥५३॥
वर्णः श्वेतो रसौ स्वादुलवणौ चिरंकारिता ।

—वा. सू. अ. १२

Translation. Moisture in excess, induration of tissue, itching sensation, chilly feeling, heaviness, stagnant condition of the secretary structures, coating of Kapha on the mucous membranes, inactivity of the limbs, swelling, weakness of digestive power, sleepiness, a pale colour of the skin, sweat and salt taste in the mouth, slow restoration to health after an illness.

Compare:

तृप्तिस्तंदा गुरुता स्तैमित्यं कठिनता मलाधिक्यम् ।
स्नेहापक्त्युपलेपाः शैत्यं कंडूः प्रसेकश्च ॥
चिरकर्तृत्वं शोफो निद्राधिक्यं रसौ पटुस्वादू ।
वर्णःश्वेतोऽलसता कर्माणि कफस्य जानीयात् ॥

—मा. नि. म. को. टीका

(d) **Aetiological Factors:** (प्रकोपन)

स्वाद्वम्ललवणास्निग्धगुर्वभिष्यंदिशीतलैः ।
आस्यास्वप्नसुखाजीर्णदिवास्वप्नातिबृंहणैः ॥१७॥
प्रच्छर्दनाद्ययोगेन भुक्तमात्रवसंतयोः ।
पूर्वाण्हे पूर्वरात्रे च श्लेष्मा

वा. नि. अ. १

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Translation. Ingestion of food which is sweet, sour, saltish, oily, heavy, slimy or increasing the mucoid secretions, and cooling ; sedentary habits ; indulgence in sleep ; indigestion ; sleeping in day-time ; taking rich food ; restraining the use of emetics ; the spring season ; the first part of the day and of the night ; the period immediately following a meal.

We shall next take up the physiological functions of the Tridoshas in the different systems of the body. Reference to the pathological phases of Tridoshas will follow in due course. Pharmacological considerations which bear a close relation to the morphological aspects of Dravyas (द्रव्य s) will be taken up at the end of the section.

PHYSIOLOGY OF VAYU.

From what has been so for said about Vayu under "Tridosha", it can now safely be assumed that Vayu is the strongest imaginable force organised in the body of man and that the power it wields comes to it from the subtle properties of Panchabhautika matter. A study of the conditions pertaining to its प्रकृति, आकृति and विकृति will enable us to understand its field of activity in the physiological and pathological states of the body. The description of Vayu given in Ayurvedic books show that it is a forceful principle which is capable of doing or undoing anything. The structure of Yayu, formed of आकाश and वायु, is expressive of the wide field of its functions and also of its superiority over the other two principles. CHARAKA gives us a very clear idea of this when he says, वातपित्तकफा देहे सर्वस्रोतोऽनुसारिणः । वायुरेव हि सूक्ष्मत्वाद्द्वयोस्तत्राप्युदीरणः ॥५७॥ — चि. अ. २८

The description that it is सूक्ष्म, स्रोतोनुसारी and द्वयोस्तत्राप्युदीरणः shows that it has a penetrative action, that it is

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omnipresent, and that it has the power to control the other principles of the body. This goes to show that it cannot be anything else than a nervous force incorporated in the body-elements.

The situation of Vayu is in the brain. CHARAKA describes it thus:

शिरसि इन्द्रियाणि इन्द्रिय प्राणवहानि च स्रोतांसि सूर्यमिव गभस्तयः संश्रितानि ॥४॥ —सि. अ. ९

The situation पक्वाधान assigned to its field of activity is only in relation to the pathological condition when Vayu is deranged by indigestion. Its place of action is in the brain and its origin in रजोगुण. Its presentations are to be seen in प्राण, अपान, उदान, समान, व्यान वायुs – all working together simultaneously like so many forces released by the prime engine प्राणवायु. To understand thoroughly all the aspects and implications of Vayu it is absolutely necessary to grasp the fundamental chemico-physical and bio-physical notions entertained about it by the Ayurvedists. These are involved in the Panchabhautika Theory already described at the beginning of this Part. Regarding the distribution of the branches of वातसंस्था (Nervous System) as described in the books on Modern Anatomy the Ayurvedists have been completely silent. It is, therefore, necessary to incorporate in this book some information regarding the distribution of Vayu as is given in the old Yogic literature. The theories pertaining to the Chakras of Yoga, though unacceptable to the Western Physiologists, cannot be dispensed with by the Ayurvedists as they provide a clue to the understanding of the relations between the main channels of Vayu and those of the Autonomous System. Let us, therefore, see what these Chakras are. The Charkas are six in number and according to Dr. V. G. Rele and others are located as under:

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Name of Ghakra.		Present Anatomical Equivalent.
1. आज्ञाचक्र	corresponds to	the Naso-ciliary extension of the Cavernous Plexus of the Sympathetic.
2. विशुद्धिचक्र	,, ,,	Pharyngeal Plexus of the Sympathetic.
3. अनाहतचक्र	,, ,,	the Cardiac Plexus of the Sympathetic System.
4. मणिपूरचक्र	,, ,,	the Plexus of Coeliac-axis
5. स्वाधिष्ठानचक्र	,, ,,	the Hypogastric Plexus.
6. मूलाधारचक्र	,, ,,	the Pelvic Plexus of the Autonomic System.

These Chakras, the extra-sensorial channels of knowledge, are physiologically nerve-channels conducting impulses, and physically psycho-physical factors, and regulate all the mental and physical phenomona in the human body. They, therefore, in a way form the very basis of the पंचप्राणs —Vayus. In fact, Vayus are nervous impulses having connections with these Chakras and travel along afferent and efferent channels in the brain, the spinal cord and the nerves.

Another thing which claims our attention here is the close connection of Vayu with the Mind, for, in the first the place मनस् is closely related to आत्मा, इन्द्रिय and इन्द्रियार्थ and therefore cannot remain isolated from the discussion on Vayu, and secondly, it forms a part of अध्यात्मद्रव्यगुणसंग्रह and also because 'life' is defined as "शरीरेन्द्रिय सत्वात्मा संयोगो धारिजीवितम्."

Thus Ayurveda, unlike the modern Science, looks upon the mind with greater countenance on account of its being an

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important factor in the maintenance of body-equilibrium. But in the Western Science mental and physical processes are kept apart. In Hindoo thought there has never been any such isolation. In this connection Professor Hiriyanna observes, " Here, as elsewhere in Indian Philosophy generally the term ' psychology ' is to be understood in its etymological sense as the science of the soul "; whereas " the science of psychology as Westerners know it, is man's attempt to explain the behaviour and the operations of his mind with reference to his body and the stimuli received through his senses. " The difference between the two is clearly set forth by Swami Prabhavananda in the following words :

"..... To the Hindu mind, psychology has its inception in the thinking self and not in the objects of thought. It is not content with merely stating the working of the mind in the normal planes of consciousness as is the case with our modern system of behaviourism, but it points out how the mind ranges beyond the ordinary conscious plane of psychic activity, and how the resulting experiences are even more real than the experiences of the objective world. It also differs from the psycho-analysis of Freud in that, though it accepts the subconscious mind, it claims that man is capable of controlling his subconscious impressions as well as his conscious mind, and of attaining to the super-conscious state, which no school of Western Psychology has yet taken into consideration. By teaching the normal mind methods of restraining its own vagaries, with the aim of gaining supreme mastery over itself, and of ultimately rising above it, Indian Philosophy distinguishes itself from all other known systems of philosophy or psychology. The Yoga-System of Patanjala deals specifically with this process of mind-control."

The causative factor in many of the mental diseases cannot, therefore be properly understood without reference to the comprehensive character of the mind. It is on account of this, the mental factor is given so much importance in the aetiology of functional diseases. In this connection, explaining the modern

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view Charles Mercier, one of the ablest writers on Psychology says, "There is no thought or mental condition without a nervous process. There is no mental condition which is not a mental shadow or equivalent, an accompaniment of some process, some discharge, some disturbance or tension of some molecular arrangement in the nervous system, feelings – therefore accompany discharges of grey matter. Thoughts accompany the passage of discharges from centre to centre....."

Now let us see how mind functions. In Ayurved the psychic phenomena are described as being started by the primal force Atman with the psycho-physical substance Manas as its instrument, Charaka says,

चेतनावान् यतश्चात्मा ततः कर्ता निरुच्यते ।
अचेतनत्वाच्च मनः क्रियावदपि नोच्यते ॥७४॥

—शा. अ. १

CHARAKA describes the characteristics and functions of Mind in the following verses in the first chapter of Shareeristhana thus:

लक्षणं मनसो ज्ञानस्याभावो भाव एव वा ।
सति ह्यात्मेन्द्रियार्थानां सन्निकर्षे न वर्तते ॥१६॥
वैवृत्त्यान्मनसो ज्ञानं सान्निध्यात्तच्च वर्तते ।
अणुत्वमथ चैकत्वं द्वौ गुणौ मनसः स्मृतौ ॥१७॥
चिन्त्यं विचार्यमूह्यं च ध्येयं सङ्कल्प्यमेव च ।
यत्किंचिन्मनसो ज्ञेयं तत्सर्वं ह्यर्थसंज्ञकम् ॥१८॥
इन्द्रियाभिग्रहः कर्म मनसः स्वस्य निग्रहः ।
ऊहो विचारश्च ततः परं बुद्धिः प्रवर्तते ॥१९॥

—अ. १

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Translation. Cognition or noncognition is the characteristics of the mind. This knowledge or cognition is not possible if only the mind comes in close contact with आत्मा, इंद्रिय and इंद्रियार्थ ; but concentration of the mind (अन्तःकरण) on the object is necessary to beget knowledge. Sublety or expansiveness and singularity or fixedness are the properties of the mind. Everything that is capable of being perceived, meditated upon, conjectured, remembered, surveyed and known comes under the perview of the mind. The actions of the mind are to grasp things with the aid of the five senses, to control itself, and to conceive or to conjecture. Buddhi functions afterwards.

Analysis of the psychic process : The order in which the psychic organs function is the reverse of that in which they appear in the 'Evolutionary Scheme' given elsewhere in this part. In the series of the instruments of cognition the senses (पंचज्ञानेंद्रियs), therefore, form the first factor, Mind the second, Self-consciousness the third, and Intellect the last. These have special characteristics which differentiate them from one another. The proper function of the Senses is to receive impressions of objects, that of the mind to form conception through the senses and synthesise –संकल्पात्मकं मनः–, that of Consciousness to percive, and that of the Intellect to determine by analysis and comparison–निश्चयात्मिका बुद्धिः. Thus the senses assisted by their organs furnish only impressions. But these impressions are not yet objects till they are grouped together and distinct ideas are formed before there can be any perception of these objects. It is the function of the mind to form these groups and thereby transform a certain number of stimuli into one perception. Further processes of perception are carried out by consciousness and intellect, till the impressions assume shape and are realised as belonging to a certain type. Thus it will be seen that when all these work in co-operation a thought is said to have formed and experience results. "If now the perception is to lead to any action the Buddhi intervenes and decides upon what action has to be

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followed and issues instructions, so to say, to the proper motor organs, the result being either some action or desistence from it. The Buddhi thus corresponds to the will-aspect of conscious life. If we use a single term अन्तःकरण for the last three elements of the psychic apparatus, we see how the internal organ in one or other of its phases is engaged, when once the senses have been stimulated, in reacting to the stimulus. In internal perception such as that of pain or pleasure the process is exactly the same; only the co-operation of the external senses (ज्ञानेंद्रिय s) is not required and they do not therefore function." It will have become clear now how the psychic process takes perception as an increasing differentiation in a presented whole.

Thus the Samkhyas look upon the mind as a special sense-organ and attribute to it a dual function, viz., discrimination and action. It is called संकल्पक because, unlike pure sense (which leads to abstractions never realised), it has the power of synthesis, and it is a sense of action because it works in closer union with the senses which are but channels for conducting impulses from the sensory routes to the mind. So the mind may be said to be an intermediary between the sensory organs and the Intellect. ईश्वरकृष्ण says " उभयात्मकमत्र मनः संकल्पकमिन्द्रियं च साधर्म्यात् " But Physiologists deny this compound character of the mind. They, however, admit that pure sensation is one thing and perception is quite another, and attribute these relative differences to different brain conditions. Thus they suggest that mind is not apart from the physical environment of which it indeed takes cognisance. But the Samkhyas and the Ayurvedists do not hold these views.

CAARAKA says,

तत्र बुद्धिमान्नास्तिक्यबुद्धिं जह्याद्विचिकित्सां च । कस्मात् प्रत्यक्षं ह्यल्पमनल्पमप्रत्यक्षमास्ति, यदागमानुमानयुक्तिभिरुपलभ्यते । यैरेव तावदिन्द्रियैः प्रत्यक्षमुपलभ्यते, तान्येव सन्ति चाप्रत्यक्षाणि ॥ ७ ॥

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सतां च रूपाणामतिसन्निकर्षादतिविप्रकर्षादावरणात्करणदौर्बल्या-न्मनोऽनवस्थात्समानाभिहारादभिभवादतिसौक्ष्म्याच्च प्रत्यक्षानुलब्धिः तस्माद-परीक्षितमेतदुच्यतेप्रत्यक्षमेवास्ति, नान्यदस्तीति ॥ ८ ॥

— च. सू. अ. ११

Translation. A wise man should give up his suspicious attitude and materialistic views tending towards atheism. What we can see actually with our eyes is very little indeed; but there is much in this world which can be ascertained by Science, Logic, and Judgment. Because those indryas by means of which we can gain knowledge of visible things, are themselves unmanifest.

The existence of many things in this world cannot be realised even though they have a regular form; because (1) they may be so near to our eyes that we cannot see them, or (2) they may be very far off, or (3) they may have a covering which may obstruct our sight, or (4) our organs of sense may be dull and inactive, or (5) there may not be the concentration of our mind upon that object, or (6) it may be mixed up with a substance of its own character so that we lose sight of it, or (7) it cannot be identified owing to its being mixed up with similar articles whose bulk may be quite out of all proportion, or (8) that it may be too delicate to be seen. We, therefore, should not be sceptic about the existence of things because they happen to lie beyond our ken-the reach of our sense-organs. Indeed they do exist.

Whatever the views regarding the conception of " Cause and effect " (कार्यकारणभाव) in the Position of Mind and Brain be, we can safely conclude that the mind and the brain ultimately come in close relation with each other. The Nervous System in Ayurved may, therefore, be said to comprehend the intellectual and the mental spheres, the sense-organs, the intermediatery centres and the nerve- channels concerned in the

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conduction paths. The intellectual phase roughly represents the psychic phase and controls the sympathetic systems; and the organic phase, viz., the five senses represent a portion of the structural side ot the nervous system. These reasonings are immediately suggestive of the way in which the modern physiologists have classified the nervous system, viz., a causal classification consisting of the central nervous system and the autonomous system. Both these systems, comprehending as they do the sensorial and extra-sensorial channels of the nerve-force in man, constitute the nervous element.

Now the physiological functions, as we have already studied, depend upon the Panchabhautika i. e. physical properties of the respective elementary groups. If we cast a glance at Table No IV given in this section, we will see that the Ayurvedic methods of the study of Physiology are altogether different from those of the modern writers. Throughout their works the Ayurvedic writers have followed on the lines of Tridosha which indicate the regulative, catabolic and anabolic processes in physiology. The fundamental principles on which organic development and systemic metabolism are based have been tenaciously adhered to in the description of Aetiology, Symptoms and Treatment. The aim of Ayurved has been as CHARAKA says,

कथं शरीरे धातूनां वैषम्यं न भवेदिति ।
समानां चानुबन्धः स्यादित्यर्थं क्रियते क्रिया ॥३४॥
त्यागाद्विषमहेतूनां समानां चोपसेवनात् ।
विषमा नानुबध्नन्ति जायन्ते धातवः समाः ॥३५॥

Translation. Treatment should be based on the principle that incongruities in the working of the Dhatus should be avoided and that the equilibrium among the Dhatus should be the rule. By avoiding causes which lead to the failure of balance, and adopting remedies which maintain this balance, uniformity in the working of the Dhatus can be kept up.

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These methods of treatment, as anybody can judge, are strictly rational and scrupulously scientific. It will be seen in the further discussion on the subject how the functional systems are associated with their respect organs. In short, a broader basis has been chosen by the Ayurvedists in order to avoid errors of commission and omission. Human organism is a peculiar combination of likes and unlikes. It is (1) extremely difficult to draw lines of demarcation between the known systems of physiology. They are undoubtedly inter-dependent. The divisions of the functional systems in modern books (2) on physiology have been based more on anatomical lines than on purely physiological findings. Ayurved, on the contrary, has stuck to the functional consideration in its treatment of the subject, and has left anatomy to serve only as a hand-mind of Physiology.

Again the functions of the silent areas of the brain have no place in modern physiology. But in Ayurved these functions are grouped with the extra-sensorial channels (Chakras). Similarly it may be said of the sympathetic endocrine system which had no place in the older terminology (but which has now been placed in a fresh chapter of much valuable significance). Though the ancients had no clear conception of the 'internal secretary glands' it must be said to their credit that they had entertained decisive notions about a sort of harmonious interaction between the various cells, tissues, organs and various other parts of the animal body. The organic correlation was assumed by them to be nervous in origin. At the present day, however, even this nervous relation is considered largely to be induced by chemical factors."..... it is through these organs, or rather their secretions, that the cerebral neurons are kept vitally active and free of foreign substances, toxins, and wastes which in many psychoses initiate the active morbid phenomena The nerve cell or neuron is a complex organ, but one in which the functional constituents of all other tissue-cells are found. Such being the case, it is plain that a deficiency or excess of the endocrine secretions will correspondingly accelerate or slow the intrinsic metabolism of

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these neurons, and thus awaken phenomena of mental excitability or depression as the case may be." (Sajous's Analytic Cyclopedia of Practical Medicine, Vol. VII). Many other systems which have been given new names in modern physiology can be grouped with one or the other of the three comprehensive systems in Ayurved.

The Nervous System in Ayurved has been described in Nadi-Prakasha as under :

नानानाडी प्रसवगं सर्वभूतांतरात्मनि ।
ऊर्ध्वमूलं अधःशाखं वायुमार्गेण सर्वगम् ॥
कंदमध्ये स्थितानाडी सुषुम्नेति प्रकीर्तिता ।
तिष्ठंते परितः सर्वाश्चक्रेऽस्मिन् नाडिकास्ततः ॥
देहे धमन्यो धन्यास्ताः पंचेन्द्रिय गुणावहाः ।
नाभिकंदस्थितास्तास्तु नाभौ चक्रे प्रवेष्टिताः ॥
तत्र प्रधानानाड्यस्तु दशवायुप्रवाहिकाः ।
प्राणोऽपानः समानश्च उदानोव्यान एव च ॥
नागः कूर्मोऽथ कृकरो देवदत्तो धनंजयः ।
एते नाडीषु सर्वासु चरंति दशवायवः ॥
एतेषु वायवः पंचमुख्याः प्राणादयःस्मृताः ।
तेषु मुख्यतमावेतौ प्राणापानौ नरोत्तमे ॥
प्राण एवैनयोर्मुख्यः सर्वप्राणभृतां सदा ॥

It will thus be seen that the principal Vayu with the help of शिरस् (Brain), सुषुम्ना (the Spinal Cord), पंचवायु (the voluntary and involuntary systems spread all over the body) and नाडीs (motor and sensory nervous) perform the functions of the Central and the Peripheral Nervous Systems.

The propertios of महाभूतवायु as is situated in Nature as well as in the Human Body:

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Before going over the organic functions of the Tridoshas it would not be out of place to refer here to the conception of the Ayurvedists regarding the powers of (the) Vayu as situated in Nature. According to the conception of the Panchabhautika theory as entertained by the followers of the Samkhya school and latter on accepted by the Ayurvedic writers, the three doshas are subtle principles which control all protoplasmic life being actuated by the stimulus provided by Atman or Mahabhoota-Vayu. This Mahabhoota-Vayu is the soul of all life in the universe. In this connection CHARAKA observes:

प्रकृतिभूतस्य खल्वस्य लोकेषु चरतः कर्माणीमानि भवन्ति, तद्यथा—धरणीधारणं, ज्वलनोज्ज्वालनं, आदित्यचंद्रनक्षत्रग्रहणानां संतानगतिविधानं, सृष्टिश्च मेघानां, अपां च विसर्गः, प्रवर्तनं स्रोतसां, पुष्पफलानां चाभिनिर्वर्तनं, उद्भेदनं च औद्भिदानां, ऋतुनांप्रविभागः, विभागो धातूनां, धातुमानसंस्थानव्यक्तिः, बीजाभि संस्कारः, शस्याभिवर्धनमविक्लेदोपशोषणेऽवैकारिकविकाराश्चेति ॥ ७ ॥

—च. सू. अ. १२

II. Vayu in the Human Body:

वायुस्तंत्रयंत्रधरः, प्राणोदानसमानव्यानापानात्मा, पवर्तकश्चेष्टानामुच्चावचानां, नियतां प्रणेता च मनसः, सर्वेन्द्रियाणामुद्योतकः, सर्वेन्द्रियानामभिवोढा, सर्वशरीरधातुव्यूहकरः, संधानकरः शरीरस्य, पवर्तको वाचः, प्रकृतिः स्पर्शशब्दयोः, श्रोत्रस्पर्शनयोर्मूलं, हर्षोत्साहयोर्योनिः, समीरणोऽग्नेः, दोषसंशोषणः क्षेप्ताबहिर्मलानां, स्थूलाणुस्रोतसां भेत्ता, कर्ता गर्भाकृतीनां, आयुषोऽनुप्रवृत्तिप्रत्ययभूतो भवत्यकुपितः ॥७॥

—च. सू अ. १२

When disturbed Vayu gives rise to many derangements such as described in the following lines.

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कुपितस्तु खलु शरीरे शरीरं नानाविधैर्विकारैरुपतपति बलवर्णसुखायुषामुपघाताय मनो व्याहर्षयति, सर्वेन्द्रियाण्युपहन्ति, विनिहन्ति गर्भान् विकृतिमापादयत्यतिकालं धारयति, भयशोकमोहदैन्यातिप्रलापाञ्जनयति प्राणांश्चोपरुणद्धि ॥७॥

—च. सू अ १२

For disturbances in Nature see art. 8 in Ch. 12.

In short, every movement, every activity, in this world whether constructive or destructive is done through the agency of this Mahavayu. In reference to this CHARAKA says,

स हि भगवान् प्रभवश्चाव्ययश्च भूतानां, भावाऽभावकरः, सुखासुखयोर्विधाता, मृत्युः, यमः, नियन्तः, प्रजापतिः, आदितिः, विश्वकर्मा, विश्वरूपः, सर्वगः, सर्वतंत्राणां विधाता, भावानामणुर्विभुर्विष्णुः, क्रान्ता लोकानां, वायुरेव भगवानिति ॥ ८ ॥

— च. सू. अ. १२

In the body this Yayu is required to co-operate with Pitta and Kapha in order to accomplish the various duties assigned to them in the organisation of life. All these three, therefore, having been evolved out of Panchabhautika constitution conduct the physiological processes of life. In them are situated the powers of Mahabhootas. heated by Atman, necessary for carrying out life-processes.

अनुष्णशीतस्पर्शोऽयं द्रव्यैर्वायुरिष्यते ।
दाहकृत् तेजसायुक्तः शीतकृत् सोमसंश्रयात् ॥

— मु. टीका

NORMAL FUNCTIONS OF VAYU

Vayu is named differently according to its location in the body and the functions it performs there. It is named as

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प्राण (Prana), अपान (Apana), व्यान (Vyana), उदान (Udana) and समान (Samana).

हृदि प्राणो गुदेऽपानः समानो नाभिमंडले ।
उदनः कंठदेशे स्यात् व्यानः सर्व शरीरगः ॥

I. **Prana-Vayu:** The location and the functions of Prana-Vayu are briefly stated by WAGBHATA in the tollowing verse:

प्राणोऽत्र मूर्धगः ।
उरःकण्ठचरो बुद्धिहृदयेंद्रियाचित्तधृक् ॥
ष्ठीवनक्षवथूद्गार निश्वासान्नप्रवेशकृत् ॥
—अ. हृ. सू. अ, १२

Translation. It traverse the head, and is also distributed over the chest and the throat. It holds in control the intellect, the heart, the sense-organs and the mind. It regulates actions such as spitting, sneezing, belching and swallowing.

According to CHARAKA the Prana-vayu is located in the cuest, the head (brain), the ears, the tongue, the eyes and the nose, for he says,

स्थानं प्राणस्य शीर्षोरःकर्णजिव्हाक्षिनासिकाः ।

The direct influence of Prana-vayu, according to both the writers, appears to be felt in the region corresponding to the space between the larynx and the base of the heart.

Prana-vayu chiefly governs the nervous of phonation, deglutition, respiration and circulation; it is linked with the branches of the upper Udana, the middle-Samana and the lower Apana-vayus through communicating branches. Associated with Udana it conducts speech and respiration, with Samana digestion,

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and with Apana reproduction and elimination. It is also connected with the Vyana-vayu through the branches of which, in particular, it manifests itself in efferent and afferent forms leading to direct and reflex actions.

According to modern descriptions in physiology the movements of the chest are governed by the respiratory centre in the pons and the upper part of the medulla, which receives afferent impressions from the Vagus, and transmits efferent impulses by the vagus to the bronchi, and by the intercostal and phronic nerves to the chest muscles and the diaphragm. The respiratory centre consists of two parts: the one inspiratory which is normally in action, and the other expiratory, which is passive. Impressions from the plumonary alveoli are conveyed by the Vagus nerve which contains both inspiratory and expiratory afferent fibres. The act of inspiration is normally checked by an inhibitory impulse passing up the inspiratory Vayu fibres at the moment when inspiration reaches its height. Normally too, it is the Vayus Nerve that controls the rate of respiration. Other factors which influence the respiratory centre are impulses received from the brain and reflex actions of the sensory nerves. The centre is also stimulated by diseased conditions such as those in fever.

Now, there are some words in the definition of Wagbhata which deserve an explaination. The word 'मूर्धगः' shows that Prana-Vayu is connected with the brain. In this connection CHARAKA observes

प्राणाः प्राणभृतां यत्रस्थिताः सर्वेंद्रियाणि च ।
यदुत्तमांगमंगानाम् शिरस्तद्भिधीयते ॥ २ ॥
—च. सू. अ. १७

Here the word 'प्राणाः' refers to the nervous centres in the brain on which the movements of the body depend. 'सर्वेंद्रियाणि' should be taken to mean all the sensory organs, according to the definition given by CHARAKA himself.

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These statements are substantiated by clear descriptio. in modern Anatomy where we see that all areas whether sen sory, motor or those connected with intellection, are situated in the brain.

The line " बुद्धिहृदयेंद्रियचित्तधृक् " shows that Prana-vayu travels over a very large area and possesses even such great powers as the control of psychic phenomena. The definition of हृदय as given in CHARAKA-SAMHITA is worth being noted down here:

अर्थे दशा महामूलाः समासक्ता महाफलाः ।
महच्चार्थश्च हृदयं पर्यायैरुच्यते बुधैः ॥२॥
षडंगमंगं विज्ञानमिन्द्रियाण्यर्थपंचकम् ।
आत्मा च सगुणश्चेतश्चित्यं च हृदिसंश्रितम् ॥३॥

—च. सू. अ. ३०

This definition of हृदय lends support to the common view accepted by all the Ayurvedists that चित्त and हृदय stand together on the metaphysical plane and work in harmony with Vayu. The reader should not misunderstand this हृदय for the organ 'heart'. The following quotation from YOGAVASISHTA solves the problem and dispels all doubt:

साधो जगति भूतानां हृदयं द्विविधं स्मृतम् ॥
उपादेयं च हेयं च विभागोऽयं तयोः शृणु ।
इयत्तया परिच्छिन्ने देहे यद्वक्षसोऽन्तरम् ॥
हेयं तद् हृदयं विद्धि तनौ एकतटे स्थितम् ॥
सविन्मात्रं तु हृदयं उपादेयं स्थितं स्मृतम् ॥
तत्तु प्रधानं हृदयं तत्रेदं समवास्थितम् ।
तदादर्शाः पदार्थानां तत्कोशः सर्वसंपदाम् ॥

— उपशम. प्र. स. ७८ श्लो. ३३–३६

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Translation: The heart of human beings in this world is of two kinds viz., उपादेय and हेय. That which is confined in a corner of the thoracic portion of the body-a frame with measured limitations is called हेय; and the other which is connected with intellect is called उपादेय. Great importance is attached to the latter where संविद् is situated, for it is a part of the universal intellect and so is, as it were, a mirror of all the things in this world. It is a store-house of all extra-ordinary powers.

Prana-vayu is thus an important nervous factor which is in connection with the Cerebro-Spinal System, the Autonomous System and some of the silent areas of the brain also-yet ununderstood by the modern writers of Anatomy, but treated at length by the writers of Yoga Philosophy.

According to Yoga-Shastra Prana-Vayu, when brought under control, as in Pranayama, is an instrumental medium for the subjugation (संयम) of the mind, which loses its individuality when submurged in the object of meditation. Yoga is described here as चित्तवृत्तिनिरोध i. e. control of the functions of mind. The aim of the Yoga-Shastra is to free the Purusha from the material bondage by laying down a progressive scheme of self realisation. This scheme consists in restraining the fluctuations of the mind (चित्तवृत्ति) by a course of strict discipline like यम, नियम, प्राणायाम etc. The ultimate object of this discipline is to attain the knowledge which leads to liberation (मोक्ष). The only difference that lies between the Samkhya and the Yoga views is with regard to the object of meditation. According to the Samkhyas the object of meditation is the eternal truth, that the essential Purusha is different from प्रकृति (ज्ञानेन च अपवर्गः). It further ad वैराग्य alone cannot bring about this knowledge, for, at the most, it may lead the body to absorption in Nature

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(प्रकृतिलय). The Patanjala-Yoga, on the contrary, postulates the existence of God or ईश्वर over and above that of Purusha. ईश्वर is the symbol of perfection and so He should be the object of meditation. The school of Yoga philosophy had, therefore, to study the scope of the mind in relation to the body and hence arose the necessity to include psychology within the fold of Yoga.

The Ayurvedists have followed the Samkhya theory of evolution which bifurcates creation (सर्ग) into सात्विक एकादशक and तामसभूतादि. The सात्विकएकादशकसर्ग becomes ऐंद्रियक when it comes in touch with तैजस् अहंकार. The evolution of mind is manifested here. But inspite of the fact that this सात्विकएकादशकसर्ग contains mind as one of its members, this सर्ग cannot create the forces called प्राणs. because Pranas cannot be subordinate to the five ज्ञानेंद्रियs and कर्मेंद्रियs which are only instruments belonging to the lower order. It is चित्त or अंतःकरण in its three-fold function of intellect (Buddhi), consciousness (Ahamkara) and mind (Manas), that manufactures and works out the forces called Pranas. At this stage the Ayurvedists have introduced the Mahabhoota-Vayu, which is further classified into two forms subtle and gross. The subtle-primal form is a very potent force manifesting itself in Nature externally. The second is the gross form of Vayu taking part in the ऐंद्रियक creation constituting the organic creation. This vayu functions differently in different localities of the body and so receives different names. It is, therefore, considered to be of five varieties, of which Prana-vayu is the most important as it regulates all the metabolic processes in the body in conjunction with the others. Thus the Nervous System of Ayurveda practically consists of शिरस्-उत्तमांग with the पंचवायुs and सुषुम्ना which latter is borrowed from Yoga. It will be

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seen in the following pages how the vayus, in collaboration with one another, can perform all the functions in the body whether belonging to the Cerebrum, the Spinal Cord, or the Sympathetic Ganglias. But it is necessary to study some of the important nervous channels such as इडा पिंगला and the सुषुम्ना to understand the working of the Nervous System and its branches as taking part in the nervous processes of the body, are also described in the Upanishads other than the main ten Upanishads. The nerves, small and large included, are stated to be seventy-two thousand in number: हृदि ह्येष आत्मा । अत्रैतदेकशतं नाडीनां तासां शतं शतमेकैकस्यां द्वासप्ततिर्द्वासप्ततिः प्रतिशाखानाडीसहस्राणि भवन्त्यासु व्यानश्चरति ॥५॥

—प्रश्नोपनिषद् प्रश्न. ३.

As it is beyond the scope of this work to locate exactly all the areas to which these nervous structures are distributed, we, for practical purposes, accept what CHARAKA and SUSHRUTA have mentioned in their Samhitas regarding these areas.

It may, for our present purpose, be assumed that the Ayurvedic writers attribute to this vayu (proper) the power of conducting efferent impulses through the nerve-centres superior and inferior cervical gangilias in the lower cervical and upper thoracic regions of the spinal cord (उरः कंठचरः), to the heart, the lungs, the larynx and the pharynx, and also of receiving impulses generated with the intake of breath and with the exercise of the sensory organs.

It is common knowledge that the sympathetic nerves transmit impulses which regulate the movements of the organs, determine vaso-motion, and control the phenomena of secretion. Nearly all the spinal and some of the cranial nerves, receive fibres from the sympathetic. The sympathetic nerves supply the involuntary muscles and are believed to have intimate relation with various trophic processes also. Somewhat similar is the position of the vayus of Ayurveda so far as

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the higher functions are concerned ; and these are combined forces having inhibitory and acceleratory functions in the nervous system.

II. UDANA-VAYU.

WAGBHATA defines 'Udana-vayu' as उन्नयनात् उदानः

उरस्थानमुदानस्य नासानाभिगलांश्चरेत् ॥५॥
वाक्प्रवृत्तिप्रयत्नोर्जाबलवर्णस्मृतीन्द्रियः ॥

—अ. हृ. सू. अ. १२

Translation: Udana-vayu is situated in the chest; it is also distributed over the areas which cover the नाभि (Nabhi of Yoga) which is defined as 'पृष्ठ वंशस्थ शरीर मध्यभाग', on the one hand and the nasal, the pharyngeal and the laryngeal passages on the other. It produces capacity for speech, effort, energy, strength, lustre and consciousness.

SUSHRUTA's definition of UDANA is more general and runs thus:

उदानो नाम यस्तूर्ध्वमुपैति पवनोत्तमः ॥१४॥
तेन भाषितगीतादिविशेषोऽभिप्रवर्तते ।
ऊर्ध्वजत्रुगतान् रोगान् करोति च विशेषतः ॥१५॥

—सु. नि. अ. १

Translation. Udana-vayu is that which has a tendency to travel in the upper direction. It controls the actions of speech, singing, and other special uses of the respiratory passages. When deranged, it gives rise to particularity to the diseases of the structures above the larynx. Both the definitions clarly indicate that Udana not only influences the respiratory tract but also affects the higher centres in the brain, namely, those of phonation and consciousness. The last line of WAGBHATA's

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definition especially conveys this meaning. It has already been mentioned that Prana-vayu in association with Udana regulates respiratory action. The meaning conveyed thereby is that Prana-vayu is a central organic force which starts all actions (प्राणांश्चप्यवलंबते), while Udana helps the actions of speech and respiration through the nerves supplying the accessory muscles. The distribution of Udana is less diffused than that of Prana-vayu and is, therefore, more localised. Yet it is spoken of as 'पवनोत्तम, by SUSHRUTA. It appears that this name conveys a special significance owing to the importance given to it in the process of 'प्राणायाम, by the writers of Yoga-tantra. According to their description the influence of Udana reaches as far above as the root of the nose (the level of the Bulb) and as far below as the नाभिकंद. In प्राणायाम the stimulation of the brain-centres, caused by the acceleratory nervous impulse (Udana) of the respiratory act brings into action Vyana, Samana and Apan in their respective areas. During this process the Udana-vayu behaves as an afferent impulse stimulating the other vayus according to requirements. The Vyana-vayu transfers the Prana impulse to the Apana-vayu. Udana-vayu, when exhibited, further takes part in the metabolic process which brings बल, वर्ण, ऊर्जा, प्रयत्न etc. to the system.

According to Yoga-Shashtra the power of restraining Kundalini (the nervous force which travels from the मूलाधारचक्र to ब्रह्मरंध्र and carries all the impulses to the vital organs and the brain) is stimulated by the exercise of Pranayama through the afferent impulse of Udana. Normally, the currents of Kundalini are constantly moving upwards and downwards through the direct communicating branches and are controlling circulatory and respiratory processes automatically and unconsciously. When it is performing its usual function it is said to be resting in योगनिद्रा-a latent state. When the Yogin wants to have his soul-Atman-liberated from the bonds of मनस् and वासना, he arouses the Kundalini by Pranayama

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through the Udana-Prana by a different route. Thereby Kundalini, which is in a dormant condition and is lying in मणिपुरचक्र, is excited and made to receive constant impressions. The impressions, rather the impulses, are carried to the various Chakras which are connected by filaments with सुषुम्नानाडी, and are further transferred to the ब्रह्मरन्ध्र. It is said that, on the way, these impulses after reaching the मणिपुरचक्र are diverted by जालंधरबंध with the help of Vyana fibres downwards as far as मूलाधारचक्र near the base of मेरुदंड (spinal column). Then the afferent- ' Udana-Prana ' comes in contact with the efferent impulse Apana-vayu generated by the मूलाधारचक्र in the region of the navel and the meeting of these two forces is said to be manifested by an internal vibration (शद्बब्रह्म). This meeting of the Prana and Apana is the first step in the awakening (conscious application) of Kundalini which further starts successive reflex impulses through Vyana-vayu. One of these -an ascending impulse-goes up through the posterior portion of सुषुम्नानाडी, simultaneously with exhalation of breath, being further assisted by उड्डियानबंध. This Bandha prevents the Udana impulse from descending downwards. Udana then rises up step by step to the cortex of the brain and transmits to it impressions brought on by the centripetal fibres. As the Kundalini, thus awakened, forces a passage upwards and reaches its goal—Bramba-randhra, the mind becomes free and open to all visions ; and as a result of this the Yogin acquires consciousness and eventually mastery over the involuntary actions of the body:—

नाभिचक्रे संयमं कृत्वा कायव्यूहं विजानीयात् ।

—व्यासभाष्य पातंजलयोगसूत्र

It is very difficult for the average reader to understand thoroughly the course of the various impulses sent byKundalini

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when it is working sub-consciously, independent of the control of the nervous system, and so it would be necessary for him to refer to books like Patanjali Yogashastra which deals exclusively with this subject. Only a superficial sketch is given here to show how extensively the Prana-vayu wields its influence in the working of the psychic powers and how it indentifies itself with the different vayus, as it changes its position. The student of modern Physiology knows that there are some portions of the nervous system over which man, ordinarily, has no control. But according to Yogic literature, man can acquire control over those systems by systematic exercise of यम, नियम, आसन, प्राणायाम, प्रत्याहार, धारणा, ध्यान, समाधि which make the body light and active and enables the performer to use his supernatural (latent) powers. The 'Bandhas' referred to are only external stimuli produced by the pressure of particular limbs on particular मर्मs during Pranayama; and the मुद्रs are certain attitudes of the body (above the neck) accompained with certain manipulations of the fingures and the heels to stop external impressions and help concentration of the mind. All these help the Yogin in securing mastery not only over physical movements but also over metabolic processes and certain psychic phenomena, which otherwise are not within his reach. CHARAKA describes the final acquisition (सिद्धि) of a Yogin in the following words:

आवेशश्चेतो ज्ञानमर्थानां छन्दतः क्रिया।
दृष्टिः श्रोत्रं स्मृतिः कान्तिरिष्टतश्चाप्यदर्शनम् ॥१३९॥
इत्यष्टविधमाख्यातं योगिनां बलमैश्वरम्।
शुद्धसत्वसमाधानात्तत्सर्वमुपजायते ॥१४०॥

—च. शा. अ. १

Translation: The Yogin, having recourse to only pure Satva-Guna and banishing all influences of Rajas and Tamas gunas, can accomplish the following;

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1. Entering the body of others,
2 Reading the minds of others,
3. Accomplishing objects as he desires,
4 & 5. Superhuman power of sight and hearing,
6. Power of remembering all incidents, whether past or present,
7. Superhuman brightness,
and 8. Power of becoming invisible at will.

Now it will be clear why the words बुद्धिहृदयेंद्रियचित्तधृक् have been placed before the word 'Prana-vayu' and the words वाक्प्रवृत्ति प्रयत्नोर्जाबलवर्णस्मृति क्रियः before the word 'Udana-vayu'. These words only indicate that the Vayus do not only control ordinary physiological functions but also exhibit certain occult powers through the extra-sensorial channels, viz., the Chakras.

III. VYANA—VAYU.

The location and functions of व्यानवायु are given by WAGBHATA in the following verses :

नाडिमुखेषु वितननात्
व्यानो हृदि स्थितः कृत्स्नदेहचारी महाजवः ॥ ६ ॥
गत्यपक्षेपणोत्क्षेपनिमेषोन्मेषणादिकाः ।
प्रायः सर्वाः क्रियास्तस्मिन् प्रतिबद्धाः शरीरिणाम् ॥ ७ ॥

Translation. Vyana-Vayu is situated in हृदय ; its speed of transmission is exceedingly fast; it travels through all the parts of the body ; and generally all the actions of the body, such as motion, putting-up, putting-down, contraction, relaxation etc. are regulated by it.

This has reference to the distribution of the sensory and motor nervous in the whole body. The statement that it is situated in हृदय suggests further its capacity to move in all

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directions owing to its association with the mind which also is situated in हृदय already referred to. CHARAKA also says

आत्मा च सगुणश्चेतः चिंत्यं च हृदि संस्थितम् ॥३॥

—सू. अ. ३०

In fact, all the reflexes in the body including those unconscious reflexes produced along the spinal cord are included within the conception of this Vayu. It, therefore, takes part in carrying blood, lymph, sweat and othar secretions of the body to their respective destinations through the influence of nervous channels. CHARAKA says:

व्यानेन रसधातुर्हि विक्षेपोचितकर्मणा ।
युगपत्सर्वतोऽजस्रं देहे विक्षिप्यते सदा ॥६८॥

—अ. हृ. शा. अ. १

Translation. Rasa-dhatu is being pumped out continuously and at all times into the blood vessels by the force of the Vyana Vayu whose function is to conduct proper circulation.

SUSHRUTA's definition of Vyana-Vayu is more explicit and hence is given below:

कृत्स्नदेहचरो व्यानो रससंवहनोद्यतः ॥१७॥
स्वेदासृक्स्रावणश्चापि पंचधा चेष्टयत्यपि ।
क्रुद्धश्च कुरुते रोगान् प्रायशः सर्वदेहगान् ॥१८॥

—नि. अ. १

Translation. Vyana-Vayu, whose branches are distributed to all the parts of the body, gives impetes to the circulation of Rasa. It helps the secretion of sweat and the circulation of blood. It also stimulates muscular actions, such as contraction, extension, flexion, lifting up and circumrotation. When it is deranged, it may cause disease in any part of the body.

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These lines evidently refer to the circulation of blood and the nerves concerned in the regulation of the vaso-motor system in cooperation with the sympathetic fibres.

IV. SAMANA—VAYU.

आहारेषुपाकार्थं वन्हेः समुन्नयनम्

WAGBHATA describes it as follows :

समानोऽग्निसमीपस्थः कोष्ठे चरति सर्वतः ।
अन्नं गृण्हाति पचति विवेचयति मुञ्चति ॥

Translation. Samana Vayu is situated near the digestive tract-gastro-duodenal region-and is distributed all over the abdomen. It admits, digests, disintegrates and assimilates food, and discards refuse. कोष्ठ is defined by CHARAKA in the seventh chapter in Shareerasthana thus:

पंचदश कोष्ठांगानि; तद्यथा-नाभिश्च, हृदयं च, क्लोम च, यकृच्च, प्लीहा च, वृक्कौ च, बस्तिश्च, पूरीषाधारश्च, आमाशयश्च, पक्वाशयश्च, उत्तरगुदं च, अधरगुदं च, क्षुद्रांत्रं च, स्थूलांत्रं च, वपावहनं चेति ॥१७॥

—च. शा. अ. ७

Translation. The fifteen parts contained in Koshtha are as follows: 1. The area corresponding to the nevel, 2. The heart, 3. The œsophagus, 4. The liver, 5. The spleen, 6. The two kidneys, 7. The bladder, 8. पूरीषधर the descending colon above the sigmoid plexus, 9. The stomach, 10. The पक्वाशय 11. The upper part of the rectum, 12. The lower part of the rectum, 13. The large intestines, 14. The small intestines and 15. The peritoneum. CHARAKA defines Samana-Vayu as

स्वेददोषांबुवाहीनि स्रोतांसि समधिष्ठितः ।
अंतरग्नेश्च पार्श्वस्थः समानोग्निबलप्रदः ॥२८॥

—चि. अ. २८

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Translation. Samana-Vayu is situated near the internal fire (of digestive organs) and is distributed over the channels that conduct sweat, the lymph and the doshas. It supplies digestive power.

Thus it will be seen that Samana-Vayu is located in the body between the heart and the navel (Pitta-sthana) and is mainly concerned with the metabolic processes pertaining to digestion. It is a form of Vayu (group of nervous communications) meant for the general adjustment of the secretory and excretory processes especially in maintaining the equipoise in the activities of the digestive organs. As already referred to, it works in conjunction with Prana, Apana and Vyana vayus. It is closely connected with Pitta-dhatu (agni) which it regulates according to circumstances. WAGBHATA describes succinctly but with marvellous accuracy the part which this agni (oxydation process) plays in cooperation with Vyana (vegetative nervous process) in the following words :

अन्नभौतिक धात्वग्नि कर्मेति परिभाषितम्।

— शा. अ. ३

For details the reader is referred to " Pachaka-Pitta." CHARAKA's words स्वेददोषांबुवाहीनि etc., in the definition, probably imply the connection of Samana-Vayu with the vasomotor nerves. This portion of the nervous mechanism has a wider significance and includes processes which adjust metabolic disturbances in Dhatus and maintain balance in the body-economy. The words " समीरणः अग्नेः " and " स्थूलाणुस्रोतसां भेत्ता " as applied to Vayu by CHARAKA (in Sutrasthana Ch. 12) apply aptly here to Samana-vayu. It must be remembered here that there are some vegetative processes in the body which are independent of consciousness and therefore are autonomic by nature. These are controlled by the different types of Vayu which are comparatively अतींद्रिय in so far as their relation to the Central Nervous System is concerned. In the the present case Samana-Vayu is probably connected with

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the splanchnic nerves arising out of the ganglia of the sympathetic portion of the autonomic system in the thoracic region.

The relation of the vayus to the digestive processes in the body are clearly stated by SUSHRUTA in the following verses:

जाठरो भगवानग्निरीश्वरोऽन्नस्य पाचकः ।
सौक्ष्म्याद्रसानाददानो वित्रेक्तुं नैव शक्यते ॥ २७॥
प्राणापानसमानैस्तु सर्वतः पवनैस्त्रिभिः ।
ध्मायते पाल्यते चापि स्वे स्वे स्थाने व्यवस्थितैः ॥ २८ ॥
—सू अ. ३५

Translation: जाठराग्नि is a very important source of heat by which food is digested. It consomes the षड्रसs and assimilates them. As it is subtle in its nature, its potency cannot be understood. It is nourished and kindled by Prana, Samana and Apana vayus in the process of digestion, in the throat and the œsophagus, the stomach and duodenum, the small intestines and the rectum respectively.

SUSHRUTA evidently refers to the nerves related to the formation, the conduction and the absorption of the secretions in the alimentary canal and attributes these important metabolic actions to the activity of the nervous mechanism concerned.

V. APANA VAYU.

Apana-Vayu मलादीनामधोनयनात्

WAGBHATA defines it as

अपानोऽपानगः श्रोणिबस्तिमेढ्रोरुगोचरः ।
शुक्रार्तवशकृन्मूत्रगर्भनिष्क्रमणाक्रियः ॥
—अ. हृ. सू. अ. १२

Translation: Apana-Vayu is chiefly located in the lumbo-sacral region but is distributed also over the gluteal, vesical,

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geneto-urinary region and the things (inguinal region). It regulates the discharge of the seminal fluid, the menstrual fluid, faeces, urine and also the delivery of the foetes.

The description given here shows that this Vayu governs the autonomic action of the colon, the rectum, kidneys, bladder and genital regions. Evidently, therefore, the impulses starting from this Vayu have connection with the lumbar and sacral portions of the sympathetic system.

In the exercise of Pranayama, Apana-vayu is generated with the expiratory impulse-रेचक-and starts from the मूलाधारचक्र stimulated by उड्डियानबंध; it then goes upwards towards the मणिपूरचक्र (the solar plexus), where it unites with Prana-vayu. Further details are given under ' Udan-Vayu '.

In short, so far as the physiological processes are concerned, Apana Vayu conducts micturition, defoecation, impregnation and parturition.

PITTA:

Pitta, like Vayu, performs different functions in the different स्थनs-localities in which it is situated and as much as receives names expressive of its specific actions in each particular locality. Thus the Pitta, which resides in प्रक्कामाशयमध्य and digests food, is called ' Pachaka-Pitta ; that which being situated in the Liver and the Spleen endows the Rasa Dhatu with pigment is known as ' Ranjaka-Pitta '; that which remaining in the Heart (उपादेयहृदय) equips man with powers like मेधा etc., is called ' Sadhak-Pitta '; that in the Eyes which enables the organ to be adapted to receive the image is known as ' Alochaka-Pitta'; and that in the Skin where it creates भ्राजिष्णुता (lustre) is called ' Bhrajaka Pitta.' Thus it will be seen that पाचकपित्त is पक्तिकृत्, रंजकपित्त is वर्णकृत्, साधकपित्त is मेधाकृत्, आलोचकपित्त is रूपकृत् and भ्राजकपित्त is कांतिकृत्. These functions of Pitta are also spoken of as the five varieties of Pitta.

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Now we proceed to deal with each one of them Seriatim.

(1) **PACHAKA-PITTA:**

WAGBHATA describes the composition, the functions, the Sthanas localities-and the significance of the name of Pachaka-Pitta in the following verses from the twelfth chapter of Sootra-Sthana:

पित्तं पंचात्मकं तत्र पक्वामाशयमध्यगम् ।
पंचभूतात्मकत्वेऽपि यत्तैजसगुणोदयात् ॥ १० ॥
व्यक्तद्रवत्वं पाकादिकर्मणाऽनलशब्दितम् ।
पचत्यन्नं विभजते सारकिट्टौ पृथक् तथा ॥ ११ ॥
तत्रस्थमेव पित्तानां शेषाणामप्यनुग्रहम् ।
करोति बलदानेन पाचकं नाम तत्स्मृतम् ॥ १२ ॥
— अ. हृ. सू. अ. १२

Translation: The Pitta principle functions differently in the five different regions of the system in which it is situated. Out of these the Pachaka is supplied to the part between the stomach and the large intestines. Though Agni in Nature is mixed up with the five rudimentary forms of matter there is an exhibition predominantly of the तैजस् property in it, and hence this principle is named 'Fire' in consequence of its having dispensed with moisture and assumed the functions of digestion. It digests food, divides it into essential and rejectable parts and fosters other forms of Pitta by imparting strength to them. The words "पंचभूतात्मकत्वेपि" applied to Pitta in the definition is rather confusive. For, one may ask why Pitta should at all be called पंचभूतात्मक. The answer is given by Dalhan in his commentary in the following verse:

अन्योन्यानुप्रविष्टानि सर्वाण्येतानि निर्दिशेत् ।
स्वे स्वे द्रव्ये तु सर्वेषां व्यक्त लक्षणमिष्यते ॥ २० ॥
— सु शा. अ.

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These words indicate how in Nature the five elements are mixed up together, and how by a process of natural selection particular elements are developed in particular tissues and organs.

Now, it is worthwhile to see what WAGBHATA has to say in connection with the stages of digestion in the mouth, the stomach and the intestines. He observes,

आदौ षड्रसमप्यन्नं मधुरीभूतमीरयेत् ।
फेनीभूतं कफं, यातं विदाहादाम्लतां ततः ॥ ५७ ॥
पित्तमामाशयात्कुर्याच्चयवमानं, च्युतं पुनः ।
अग्निना शोषितं पक्वं पिंडितं कटु मारुतम् ॥ ५० ॥
—अ. हृ. शा. अ. ३

Here he describes how food is acted upon by saliva in the mouth, by acid and enzymes in the stomach, and by the bile in the duodenum and the small intestines. The last line refers to (1) the process of absorption by the intestinal glands and the villi, (2) the peristatic movements, (3) the absorption of the watery content in the large intestines, and (4) the formation of fæcal mass and gases. Lastly Pachakaagni is described to be the most important of all the remaining digestive agents as upon its perfection depends their general and nutritional strength WAGBHATA says

अन्नस्य पक्ता सर्वेषां पक्तॄणामधिको मतः ।
तन्मूलास्ते हि तद्वृद्धिक्षयवृद्धिक्षयात्मकाः ॥ ७१ ॥
—अ. हृ शा. अ. ३

Besides the gastric element–Jathara-agni–mentioned under Pitta, there are two other types of Agni which requires to be noted down here. These are भूताग्नि and धात्वग्नि. Out of these three varieties, i. e. अन्नभौतिकधात्वग्नि, अन्नाग्नि is clear enough.

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It is energy emitted during the chemical process of digestion. भौतिकाग्नि and धात्वग्नि are the latent energies of the Pancha-bhootas and the potential energies of the Sapta-Dhatus respectively. These energies, as we all know, are really potential energies obtained from the rudimentary energies and the three constituents (Trigunas) of Nature. In fact, energy, is neither created anew nor destroyed completely. For instance, the energy locked in food-material of plants has its source in the energy supplied to it by air and sunlight. Similarly the energy in our muscles is obtained from the food we eat, the energy in the food, in its turn, comes from the plants, that in the plants from the elements and so on. By continual analysis and synthesis kinetic energy is transformed into latent and the latent into the kinetic. That this is the case in respect of the energies stocked in all the dravyas is stated by WAGBHATA in the following verses thus :

ये पाचकांशा धातुस्थास्तेषां मान्द्यातितैक्ष्ण्यतः ।
वृद्धिक्षयश्च धातूनां जायते श्रुणु चापरम् ॥
द्रव्यं तुल्यं विशिष्टं हि स्वं स्वं वृद्ध्यै क्षयाय च ।
प्रत्यात्मबीजनियतं भृशमाशु प्रजायते ॥

—अ. सं. सू. अ. १९

Translation: The growth or decay of the dhatus depends upon the activity or inactivity of the digestive elements existing in them. The agreement between the properties of the constituents of a पोषकद्रव्य and those of a पोष्यधातु adds to the strength of the latter and disagreement or difference to wasting. This is strictly in accordance with the nature of their Pancha-bhautika source which they inherit.

In corroboration of the law that like things are absorbed and assimilated by like ones WAGBHATA says

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भौमाप्याग्नेयवायव्याः मंचोष्माणः सनाभसाः ।
पंचाहारगुणान्स्वान् स्वान् पार्थिवादीन् पचंत्यनु ॥ ५९ ॥

—अ. हृ. शा. अ. ३

(2) RANJAKA-PITTA:

WAGBHATA defines Rajaka-Pitta as आमाशयाश्रयं पित्तं रंजकं–रसरंजनात् ॥ १३ ॥

—वाग्भट सू. अ. १२

Translation: That Pitta whose place of action is the stomach and the adjacent regions of Pitta-Sthana is named 'Ranjaka-Pitta'' on account of its property of imparting pigment to Rasa-dhatu the crude form of blood.

It is necessary to understand here what आमाशय is CHARAKA defines it thus:

नाभिस्तनान्तरं जन्तोरामाशय इति स्मृतः ।
अशितं खादितं पीतं लीढं चात्र विपच्यते ॥ २४ ॥
आमाशयगतः पाकमाहारः प्राप्य केवलम् ।
पक्वः सर्वाश्रयं पश्चाद्धमनीभिः प्रपद्यते ॥ २५ ॥

— वि. अ. २

Amashaya is here described as the region between the level of the breasts and that of the navel (Nabhi). The organs which may be included in this region are the Stomach, the Duodenum, the Liver, the Spleen and the Pancreas. We shall now see which of these organs are useful in imparting pigment to rasa.

This terse but very significant definition of Ranjaka-Pitta is given by almost all the Ayurvedic writers in their works.

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Their statement will be found to be consistent with facts, when we compare it with the opinion of modern writers on the subject. Starling in his Physiology says, " Under normal conditions the haemoglobin is broken up in the liver, part of the haemoglobin being transformed into billirubin and turned out of the body with the faeces, while iron is stored up in the liver to assist in the formation of fresh haemoglobin or new blood corpuscles." In this connection SUSHRUTA also observes

स खलु आप्यो रसो यकृत्प्लीहानौ प्राप्य रागमुपैति ॥ ४ ॥
रंजितास्तेजसा त्वापः शरीरस्थेन देहिनाम् ।
अव्यापन्नाः प्रसन्नेन रक्तमित्यभिधीयते ॥ ५ ॥
— सू. अ. १४

Translation : आप्यरस having reached the liver and the spleen receives the pigment (haemoglobin). When the fluids of the body, in a healthy state, are thus endowed with (enriched by) the pure haemoglobin (the पित्त) residing in (the Pitta-sthanas of) the body they get the name Rakta-blood.

Since WAGBHATA mentions Amashaya in a general way as the seat of Ranjaka-pitta, it need not be supposed that the liver is excluded thereby. In fact, though Pitta, as already said, is only one principle it manifests itself in many forms to perform different functions in different regions on different occasions. The classification of पंचात्मक broadly explains the properties of Pitta situated in different regions where it exhibits itself for carrying out organic functions. So, as the active processes of digestion are conducted in the region between Stana and Nabhi, and also as यकृत् and प्लीहन् are always mentioned in connection with digestion and the formation of blood and the circulation, particularly as one of the seats of Ranjaka-pitta, there remains little doubt for the assumption that the liver was within the view of the ancient writers when they made mention of Amashaya-pitta (आमाशयपित्त). The reader should note the chemical behaviour of पित्त in different localities.

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Again there are references made by WAGBHATA in the third chapter of Shareerashana regarding the movements of the gastro-intestinal tract where it is pointed out how bile forms one of the juices which act on food-stuffs.

Other Phases of पित्त

Regarding the elucidation of प्लीहन् as a haemopoitic organ SUSHRUT says

शोणितस्य स्थानं यकृत्प्लीहानौ, × × × ×
तत्रस्थमेव शेषाणां शोणितस्थानानामनुग्रहं करोति ॥ १६ ॥
—सु. सू. अ. २१

This statement finds support in the latest books on physiology. There is one more point regarding the action of पित्त which deserves to be mentioned here. It is that pitta does not mean only a means of digestion but it is also an important principle which by its catabolic process, often, is a means of oxygenation of blood. Its functions are as all the Ayurvedic writers have stated राग-पक्ति-ओजस्-तेजस्-मेधस्-उष्मकर्तृपित्तं पंचधा प्रविभक्तमग्निकर्मणा अनुग्रहं करोति ॥ ५ ॥

— सु. सू. अ. २१

To cite an example where Pitta is अग्निमूलक and not purely जठराग्निमूलक we quote the following verse from Dalhana's commentary of Sushruta:

क्रोधशोकश्रमकृतः शरीरोष्मा शिरोगतः
पित्तं च केशान् पचति पलितं तेन जायते ॥ ९ ॥
—सु. सू. अ. २१

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On deeper consideration of the meaning of the five-fold function of Pitta it will be clear that the work of Pitta is accomplished through the medium of blood. Ayurvedists attach the same importance to शोणित (blood) as to Tridoshas, as will be seen from the following quotation

नर्ते देहः कफादास्ति न पित्तान्न च मारुतात्।
शोणितादपि वा नित्यं देह एतैस्तु धार्यते ॥

—सु. सू. अ. २१

Rakta is here described as one of the main channels through which the doshas, the dhatus and the malas are conveyed to all the parts of the body, after being disintegrated and reduced to finer elements. Pitta is, again, identified in many places with ' vascularity ' and is thus used in the description of the pathology of diseases.

वादादृते नास्ति रुजा न पाकः।
पित्तादृते नास्ति कफाच्च पूयः ॥
तस्मात् समस्तान् परिपाककाले।
पचन्ति शोफांस्त्रय एव दोषाः ॥ ० ॥

—सु. सू. अ. १७

Pitta here does not mean digestion (alimentary) but it bears reference to all those pathological changes in the blood, during the inflammatory processes, such as hyperaemia, congestion, leucocytosis, diapedesis, phagocytosis, etc. SUSHRUTA makes this clear in the following line पचत्यतः शोणितमेव पाको मतोऽपरेषां विदुषां द्वितीयः ॥ ९ ॥

—सु. सू. अ. १७

Again the derivation of the word ' Pitta ' from the root ' तप ' (संतापे) is clearly significant of the heating (आग्नेय) virtues of Pitta. It, therefore, goes without contradiction that it is one of the most important constituents of blood bearing oxidising properties ; while mentioning the qualities of Sapta-

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dhatus, Dalhana says अतिरिक्तागुणारक्ते वन्हेः etc. This clearly shows that the properties of Agni are concentrated in blood.

SADHAKA-PITTA:

Sadhaka-Pitta is defined by WAGBHATA as बुद्धिमेधाभिमानाद्यैरभिप्रेतार्थसाधनात् ॥ १३ ॥ साधकं हृद्गतं पित्तम् + +

—अ. हृ. सू. अ. १२

Translation: Sadhaka-Pitta is situated in हृदय and is so named on account of its power to enable man to accomplish his desired object by virtue of intellect, memory, self-apperception etc.

From this definition it is clear that हृदय is the place, and provision of cerebral (intellectual) energy is the function, of साधकपित्त. All the three commentators of Wagbhata, viz., सर्वांगसुंदरा, पदार्थचंद्रिका and हेमाद्रि, have based their interpretation on the two words बुद्धि and मेधा and have referred the energy required by the body for the fulfilment of a desired object to this Pitta. So it is possible that this Pitta is an, embodiment of both the forces indicated by चैतन्य and तैजस् energies ; and for the location of these two energies there can be no place in the body other than the (उपादेय) हृदय already mentioned under प्राणावायु. हृदय is the चेतनास्थान as agreed to by almost all the Ayurvedic writers and also the उपनिषत्कारs

हृदिस्था देवताः सर्वा हृदि प्राणाः प्रतिष्ठिताः ।
हृदि प्राणाश्च ज्योतिश्च निवृत्सूत्रं च यन्महत् ॥

Sadhaka-Pitta is therefore to be construed as a type of intellectual energy residing in such a हृदय which is at once the abode of प्राणवायु and other higher faculties, because it supplies nervous energy to all the organs. It is the fountain of energy whence is supplied strength to

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accomplish धर्म, अर्थ, काम and मोक्ष – the four-fold end of human existence in the world. It is again the nervous energy the origin of which is traced to Satva-guna. It compares favourably with शुद्धसत्व described by CHARAKA in पुरुषविचय Ch. 5 Shareersthana, in the following words :

विद्यासिद्धिर्मतिर्मेधा प्रज्ञा ज्ञानं च सा मता ।

Sadhaka-pitta is, therefore, a subtle body - subtler than others, where-in the two principles wata and pitta, or the primal constituents [रजस् and सत्व] are placed in a highly specialised form.

Physiological descriptions also given by wagbhata and charaka are in agreement regarding the composite character of this Pitta. WAGBHATA says आग्नेयानिः– दर्शनम्, रूपम्, पित्तम्, उष्मा, पक्तिः संतापः, मेधा, वर्णः, भाः, तेजस्, शौर्यं च ॥

—शा. अ. ५

The definitions बुद्धिहृदयेंद्रियाचित्तधृक् and बुद्धिमेधाभिमानाद्यभिप्रेतार्थसाधनात् of Prana-vayu and Sadhaka-pitta respectively approach each other in their general sense.

Regarding the sources which regulate body-temperature also both the Ayurvedists and the modern writers on physiology agree with each other, in their opinions. CHARAKA, in this connection, says

आयुवर्णो बलः स्वास्थ्यमुत्साहोपचयौ प्रभा ।
ओजस्तेजोऽग्नयः प्राणाश्चोक्ता देहाग्निहेतवः ॥

—च. चि. अ. १५

Translation:— Longevity, complexion, strength, health energy, body - temperature, lustre, vital energy, the twelve agnis and the Pranas are stated to be due to body-heat.

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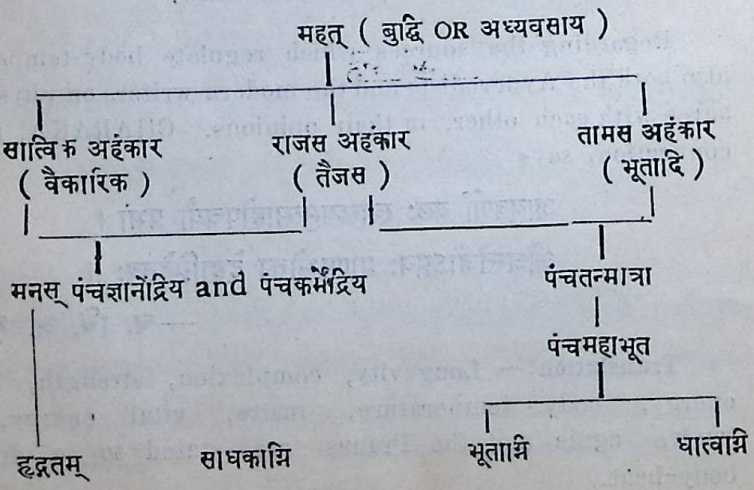
The opinion of modern writers also tends towards the same in respect of the control of temperature by the brain. A. J. Clarke says:

"The body temperature is maintained constant by a heat-centre or centres in the brain which regulate the heat production and heat loss. The chief heat centre is probably situated is the hypothalamic region. The Corpus Striatum also controls the body temperature. For mechanical injury to this region causes a rapid rise of temperature."

It may be remaked in a general sense, therefere, that तैजसगुण (one of the three primal constituents) is a primal force which holds together both Vayu and Agni and supports their interdependence. Every movement in thought, word or deed, and every phenomenon, whether chemical, physiological or psychological, is referred to Trigunas and their activities. Hence the close co-operation of Agni and Vayu in the maintenance of heat and energy of the body. Thus the propriety of placing the साधकाग्नि-an engine which starts actions-along with the other agnis is explained thereby.

The relation between साधकाग्नि and धात्वग्नि is schematically arranged in the following table:



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On studying the above table we understand that all the four items namely, (1) मनस्, (2) हृदय, the seat of Pranavayu, (3) साधकाग्नि and (4) the तैजस principle in धात्वग्नि have a common purpose to accomplish.

(4) ALOCHAKA-PITTA:

Alochaka-Pitta has been defined by WAGBHATA as

रूपालोचनतः स्मृतम्। दृक्स्थं आलोचकम्

—अ. हृ. सू अ. १२

Translation: The power in the eye which brings about the reflection of an object and presents an image is called" आलोचक-पित्त ". It is explained by SUSHRUTA as under :

पलं भुवोऽग्नितो रक्तं वातात् कृष्णं सितं जलात् ॥ ११ ॥
आकाशादश्रुमार्गश्च जायन्ते नेत्रबुब्दुदे ॥

—सु. उ. तं. अ. १

The eye-ball, like the other organs, is described by Ayurvedists as being made up of all the five elements; yet the predominance of अग्नि-तैजसतत्व is greater owing to the organic requirements in the adjustment of eye-sight, which mainly depends upon the reflection and refraction of light-rays. This energy is called 'Alochaka-Pitta.' SUSHRUTA refers to this in the following words:

मसूरदलमात्रां तु पंचभूतप्रसादजाम्।
खद्योतविस्फुलिंगाभां सिद्धां तेजोभिरव्ययैः ॥ ३ ॥
आवृतां पटलेनाक्ष्णोर्बाह्येन विचराकृतिम्।
शीतसात्म्यां नृणां दृष्टिमाहुर्नयनचिंतकाः ॥ ४ ॥

—सु. उ. तं. अ. ७

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The second line in the above refers to the inherent power of the organ of sight.

(5) **BHRAJAKA-PITTA:** Bhrajaka-Pitta is defined as "त्वक्स्थं भ्राजकं भ्राजनात्त्वचः."

Translation : The pitta that is situated in the Skin is called 'Bhrajaka-Pitta' owing to its quality of imparting lustre to the skin.

And the skin is described by Sushruta in Shareerasthana Ch. 4 as consisting of seven structures arranged one above the other in succession; they are 1. अवभासिनी, 2. लोहिता, 3. श्वेता 4. ताम्रा 5. वेदिनी 6. रोहिणी and 7. मांसधारा. These are undoubtedly the extensions of the limitary membrane which forms part of the integument of the body or its involutions. "The relation between the limitary membrane of the true skin and that of the alimentary canal, which is directly continuous with it, is well observed in the course of development. This is well seen in the case of certain pathological conditions like भगंदर (anal fistula) or salivary fistula, where the limitary membrane runs in continuation with the mucous membrane" The first of these, viz., the अवभासिनी layer in particular exhibits the properties of the Pitta principle. SUSHRUTA defines it as

या सर्ववर्णानवभासयति पंचविधां च छायां प्रकाशयति, सा व्रीहेरष्टादशभागप्रमाणा. सिध्मपद्मकंठकाधिष्ठाना; ॥ ४ ॥ —सु. शा अ. ४

What the great writer means here is that this Pitta enables the अवभासिनी layer to transmit layers of sub-epidermal colours from below upwards and makes it exhibit the five chemico-physical (छाया) energies inherent in its structure. This five-fold function (पंचभूतकृतत्वात्) consists of the regulation of (1) cutaneous heat, (2) Moisture, (3) vasomotor mechanism, and (4) adjustment in accordance with the surrounding medium, and (5) the condition of epidermis itself upon which other

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factors such as those found in diseases (कुष्ट) depend. It is needless to mention here that the processes of absorption radiation, convection, evaporation and maintenance of uniform temperature under both normal and abnormal environments are involved in the statement of Sushruta. The same writer while describing the course and function of the (तीर्यग्गानाम्) peripheral nerves going to the skin says,

तीर्यग्गानां तु चतसृणां धमननामेकैका शतधा सहस्रधा चोत्तरोत्तरं विभज्यन्ते तास्त्वसंख्यातास्ताभिरिदं शरीरं गवाक्षितं विबद्धमाततं च, तासां मुखानि रोमकूपप्रतिबद्धानि यैः स्वेदमभिवहन्ति रसं चाभिसन्तर्पन्त्यन्तर्बहिश्च तैरेव चाभ्यंगपरिषेकावगाहालेपनवीर्याण्यंतःशरीरमभिप्रतिपद्यंते, त्वचि विपक्वानि, तैरेव स्पर्शं सुखमसुखं वा गृण्हाति ।

तास्त्वेताश्चतस्रो धमन्यः सर्वांगगताः सविभागा व्याख्याताः ॥ ९ ॥

—सु. शा. अ. ९

Translation: The four nerves, which are distributed peripherally, are divided into hundreds and thousands of branches, and so they are innumerable. The body is as it were perforated by their endings and bound and held by their fibres. Their ends are inserted at the roots of the hair-follicles, they stimulate the exudation of sweat, help the distribution of Rasa-dhatu inwards and outwards. It is through their influence that the वीर्य (properties) of the drugs used in inunctions, immersions and medicated baths is absorbed in the skin and then made to act upon the body, and that the sensation of touch becomes pleasurable or otherwise.

There is, therefore, no doubt that Bhrajaka-pitta serves an important purpose in the maintenance of the natural lustre of the skin by regulating the peripheral heat mechanism. SUSHRUTA's quotation explains beautifully how the cutaneous nerves are connected with the sympathetic system and how by

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means of that connection they control radiation, perspiration, absorption and sensation.

To substantiate the above statement we may take another instance and this time from pathology and explain how the superficial layers lose their functions when affected by कुष्ट. SUSHRUTA says;

स्पर्शहानिः स्वेदनत्वमीषत्कण्डूश्च जायते ।
वैवर्ण्यं रूक्षभावश्च कुष्ठे त्वचि समाश्रिते ॥ २२ ॥

—सु. नि. अ. ५

The pathological changes as seen in the affection of skin by कुष्ट are (1) disturbance of the influence of the cutaneous nerves, (2) radiation of heat, (3) appearance of a little perspiration followed by itching sensation, (4) loss of lustre and (5) feeling of dryness.

KAPHA.

General Functions or Scope of Kapha in the Metabolism.

Of the Three Doshas, Kapha is the only one which is least understood by the western Scholars and about which a lot of confusion still prevails in some quarters, and hence it is necessary to understand, at the very outset, what exactly the functions of Kapha are in the economy of body constitution.

Out of the Tridoshas, which control all the physiological functions of the body, Vayu can be described as the chief motive principle consisting or the nerve-force or the cell-force; Pitta as that which keeps up the heat and energy of the body by means of the five varieties of Agni already referred to ; and Kapha as that which neutralises the superfluous heat.

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We shall now see how this normal adjustment of body-heat or thermotaxis is maintained. Writers on Physiology tell us that the heat-production is increased by the ingestion of food, exercise and exposure to cold (vaso-construction), and that the heat-production occasioned by the bodily activities is usually in excess of that needed to maintain the body temperature. This superfluous influence of heat-agni-must be counterbalanced, otherwise the system is sure to cease to exist. It is Kapha, the third principle in the Trinity that does the work of counterbalancing the influence referred to above by regulating the body temperature. The phenomenon is as simple as it is natural. Foster, while referring to such counterbalancing forces in the body, describes it thus, "The animal body dies daily in the sense that every moment some part of its substance is suffering decay and is undergoing combustion. In fact, combustible in the ordinary sense of the word animal body is not, by reason of the large excess of water which enters into its composition ; but an animal body thoroughly dried will, in the presence of oxygen, burn like fuel and like fuel give out energy and heat." The exhibition of heat-energy is, however, mainly due to the oxidation of the material consumed as food. Most of the food we ingest possesses potential energy, though it only provides us with the free energy when its temperature exceeds that of our body. Muscular energy is derived from the oxidation of food or its derivatives in the tissues. Compare the following from CHARAKA :

पंचोष्माणः पंचाहारगुणान् स्वान् स्वान् पार्थिवादीन् पचति ॥

—— च. चि. अ. १५

Fats and carbohydrates are the chief sources of energy as the final products of their combustion are Co_2 and H_2O ; but proteins are not completely oxidised in the body. Urea, uric acid, creatinine etc. are formed and these have potential energy value. Now, as these food-principles are first disintegrated in the alimentary canal, then carried to the liver, and thence to the tissues and viscera, it naturally follows that the production of heat first takes place in the digestive tract.

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Ayurvedists hold the same views as according to them the heat-stations in the body are stated to be ग्रहणी, आमपक्वाशय, यकृत्, अग्न्याशय etc. from the stand-point of alimentary digestion. BHAVAMISHRA. referring to body-heat, describes the nature of Pitta in the following verses with wonderful clarity and definitude :

द्रवंस्निग्धमधोगं च पित्तंवान्हिरतोन्यथा ।
तस्मात् तेजोमयंपित्तम् पित्तोष्मा यः सशक्तिमान्
स संचरति कुक्षिस्थः सर्वतो धमनीमुखैः ।
स कायाग्निः स कायोष्मा स पक्ता स च जीवनम्

—गर्भ. प्र. अ. १

Now the heat given out in the way mentioned above must have some outlets in the system as otherwise the body-equilibrium may suffer. These outlets are :

1.	The Skin	Through radiation, evaporation and invisible perspiration.
2.	The Lungs and the Respiratory Passages.	Through evaporation and warming of the inspired air.
3.	Urine and Faeces	As actual and potential heat are lost with the excreta.

These outlets are supplied by Kapha and Kapha-sthanas whose functions are well suited for the neutralisation of the excess of पित्त. If we compare the physical characters and the pathological properties of Kapha with those of Pitta we shall realise how anabolism and catabolism are both necessary for health. For details the reader is referred to the articles on Tridoshas and Sapta-dhatus. The principles of Ayurveda with regard to the maintenance of balance in the body economy [धातुसाम्य] are almost of a basic nature when considered from

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all points of view, viz., the evolutionary, the developmental and the metabolic. These views are expressed in the well-known quotation from सुश्रुत

विसर्गादानवेक्षेपैः सोमसूर्यानिलायथा ।
धारयंति जगद्देहं कफपित्तानिलास्तथा ॥

विसर्ग and आदान which stand for Kapha and Pitta, though apparently opposite in character, work in harmony to maintain body-equilibrium. The tradition of Hindu thought always tends towards the verification of particular inductions by the general principles of Nature and of कार्यकारणभाव.

Referring to the similar ways of Nature by which heat is counterbalanced in the universe SUSHRUTA's commentator Dalhana quotes the following verse which is very significant from the evolutionary point of view.

अद्भ्योऽग्निर्ब्रह्मतः क्षत्रमश्मनो लोहमुत्थितम् ।
एषांसर्वत्रगंतेजः स्वासु योनिषु शाम्यति ॥
—सु. शा. अ.

Translation: Fire has sprung from the water-principle, the martial race from Brahman and the metals from ores. The energy, which is being emitted by all these, finds a neutralising medium in their original sources : fire is neutralised by water, the martial power is overpowered by the Bramha element, and metals are reconverted into stones as they wear out by age.

In other words the disposition of molecules in living matter or in aggregates of substances is so arranged by nature (heredity) that the determination of their mutual proportion is left to their metabolic or molecular functions in the evolutionary stages that are to follow. So what the Ayurvedists mean is that natural selection works as surely through bio-chemical modifications as through structural and physical ones. The trend of this sort of conception has been confirmed by SUSHRUTA in the following verse :

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स्वभावमीश्वरं कालं यदृच्छां नियतिं तथा ।
परिणामं च मन्यन्ते प्रकृतिं पृथुदर्शिनः ॥

—सु. शा. अ. १

The function of Kapha as indicated by the word विसर्ग will be easily understood if we trace it to its root meaning. विसर्ग means 'giving' 'adding' or 'creating'. We know that Kapha is formed of the atoms of पृथिवी and जल (केन–जलेन फलतीति). So Kapha inherits the original properties of both these elementary forms. पार्थिव properties are described as " स्थैर्यबल-संघातोपचयकरम् " by SUSHRUTA, and the आप्य properties as " स्नेहनह्लादनक्लेदनबंधनविष्यंदनकरामिति ". It is no wonder, therefore. if CHARAKA describes Kapha as " प्राकृतस्तु बलं श्लेष्मा–सचैवओजः etc., "

—सू. अ. १७

This 'बलदानं' is nothing but the strength secured to the body by processes of 'assimilation'. Assimilation, in the words of Halliburton, is equivalent to " the act of living tissues in selecting, appropriating and making part of themselves the substances brought to them by the nutrient blood-stream on the one hand and from the alimentary canal on the other. " This process of 'बलदान' as understood by the Western Physiologists is purely of a chemical nature. But as the tridosha theory of the ancients is based on the theory of the genesis of Atoms their conception of Kapha has a still deeper meaning and so is more chemico-physical than purely chemical. It will now be easy for the reader to understand why the karmas of Kapha are described as " श्लेष्मास्थिरत्वंस्निग्धत्वं संधि-बंधक्षमादिभिः, " The function 'क्षमा' can be explained by the protective and preservative properties of Tarpaka-Kapha which will be explained hereafter. The properties 'स्थिरत्व' and 'स्निग्धत्व' can be traced to those of Satva and Tamas which are heavy, durable and protective.

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We shall now proceed to the consideration of the different functions which Kapha performs in the different Sthanas in which it is situated. The localities and the names by which it is known are :

NAME :	LOCALITIES.
1. Avalambaka-Kapha	उरस् and रसधातु.
2. Kledaka-Kapha	आमाशय and the gastro-intestinal tract where the secretions are active.
3. Bodhaka-Kapha	जिव्हा and the buccal cavity.
4. Tarpaka-Kapha	The head and the sense-organs.
5. Shleshaka-Kapha	The joints and the synovial areas.

We shall deal with each of these one by one.

I. AVALAMBAKA-KAPHA:

This has been defined by WAGBHATA as

उरस्थः स त्रिकस्य स्ववीर्यतः ।
हृदयस्यान्नवीर्याच्च तत्स्थ एवाम्बुकर्मणा ॥ १५ ॥
कफधाम्नां च शेषाणां यत्करोत्यवलंबनम् ।
अतोऽवलंबकः श्लेष्मा

त्रिक — शिरोबाहुसंधानस्थानम् ; अन्नवीर्य–रस
अवलंबन — स्वकार्यसामर्थ्योत्पादन.

Translation: That Kapha which is located in the chest clings to it (supports) by virtue of its intrinsic quality, nourishes the heart by means of सोमगुणभूयिष्ट अन्नरस and simultaneously enables all other seats (of action) of Kapha to perform their respective functions by supplying them humidity, -body-water, is called " Avalambaka kaqha. "

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Thus it will be seen that Avalambaka-kapha is the most important of all the forms of Kapha as upon its support depend the functions of the other kaphas. To some extent this statement is made with some reservations, because Avalambaka-kapha is after all a store-house of Kapha-Dhatu, while Kledaka-kapha is the source-the spring from which Kapha pours out. This store-house receives its supply from the food and drink consumed and also from the products of metabolism.

This store-house constituting Avalambaka-kapha somewhat resembles the body-water described in the latest books on Physiology. It is situated according to their description, in three areas, viz., (i) the liquid portion of blood, (ii) the intra-cellular fluid and (iii) the interstitial fluid. The body-water performs a double function by supporting the cellular elements with स्नेह and helping the functions of the cell in the processes of absorption and elimination. In the opinion of the Ayurvedists also the Kapha-Dhatu is to be found in रस, मांस, मेदस्, मज्जन्, शुक्र and also in शिराः (the blood-vessels) as a member of the TRIDOSHA-TRINITY. In this connection SUSHRUTA says,

न हि वातं शिराः काश्चित् न पित्तं केवलं तथा ।
श्लेष्माणं वा वहन्त्येता अतः सर्ववहाः स्मृताः ॥ १६ ॥

—सू. अ. ७

Now the word 'स्ववीर्यतः' points to the legitimate place of Kapha —उरस्—in the body from the stand-point of selective action in the natural arrangement of the different organs in the body. SUSHRUTA's words in this connection are suggestive of such an arrangement :

वातपित्तश्लेष्माण एव देहसंभवहेतवः
—— —— —— ——
—— —— —— ——
—— —— —— शरीरं भवति ॥ ३ ॥

—सू. अ. २१

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A similar idea regarding the development of the organs is met with in the writings of modern authorities on the subject. Starling says, "It must also be noted that the lungs in their development grow out from the front part of the alimentary canal into the part of the body-cavity on each side, the pleural cavity."

It is but natural, therefore, that the important Sthanas of Kapha should be in the upper part of the chest where the larynx, the lungs, and the heart are situated. Now the importance attached to Avalambaka-kapha by WAGBHATA appears to be due to Rasa which is in fact the most important source of Kapha in the body. The mention of हृदयावलंबन is in connection with this Rasa whose relations to food (अन्नवीर्य) has already been gone over. The Avalambaka-kapha may be said to be the resultant of a process of partial dehydration of the dialysable substances in the food. It forms the सोमात्मक portion of chyle, lymph and blood-plasma. The पोषकरस which is a source of Kapha to all the other forms of it, is essentially a Prasanna-dhatu. It is a known fact that assimilation is effected by this lymph (rasa) which escapes from the blood through the walls of the blood-vessels, which bathes all the anatomical elements, and from each one of these draws those materials which are necessary for its maintenance and growth.

The Kitta-dhatu of Rasa is also called Kapha but it is in a विकृत form. Its distribution or elimination as the case may be in through the lungs and the mucous membrane of the respiratory passages. Kitta-dhatu is a term which can only be used in a comparative sense. We have seen how even Malas of the Seven Dhatus are useful in maintaining balance in the body constitution, because parts of the so-called Malas are actual secretions which after a process of hydrolysis are utilised in the body, the superfluous portion being discharged as excretions.

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II. KLEDAKA-KAPHA.

WAGBHATA defines Kledaka-kapha as यस्त्वामाशयसंस्थितः ।
क्लेदकः सोऽन्नसंघातक्लेदनात् ।

Translation: The Kapha which is situated in आमाशय and which moistens the bolus and disintegrates it is called 'Kledaka-kapha'.

The purpose of Kledaka-kapha is to moisten food. The secretions of Amashaya, being liquid and mucilaginous, perform the क्लेदक function. The flow of this secretion is directly stimulated by the presence of food and indirectly by the nerves of stomach. In view of the sweet. alkaline and mucilaginous nature of the secretion it would be proper to interpret आमाशय here as the upper part of the stomach, because the juices secreted by the glands of the fundus and the pyloric portion are acid in nature. SUSHRUTA explains sufficiently clearly the chemical nature of Kledaka-kapha in the following verse :

माधुर्यात् पिच्छिलत्वाच्च प्रक्लेदित्वात् तथैव च ।
आमाशये संभवति श्लेष्मा मधुरशीतलः ॥ १३ ॥
—सु. सू. अ. २१

Translation: As the secretions in the Amashaya are liquid, mucoid and sweet in character, the श्लेष्मा produced there is sweet and of a cooling nature.

The successive stages of digestion are clearly explained by WAGBHATA in the following verses :

आदौ षड्रसमप्यन्नं मधुरीभूतमीरयेत् ।
फेनीभूतं कफं, यातं विदाहादाम्लतां ततः ॥ ५७ ॥

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पित्तामामाशयात्कुर्याच्चयवमानं, च्युतं पुनः ।
अग्निना शोषितं पक्वं पिंडितं कटु मारुतम् ॥ ५८ ॥
—वा. शा. अ. ३

Translation: The food, though consisting of the six Rasas, becomes sweet and frothy on account of the local influence of the glands of the mouth which in its turn induces the Kapha-secretion. When it is being pushed downwards, after having assumed the acid and heating character of the gastric secretion, it produces Pitta. During its descent towards the descending colon it loses its moist character, gets thoroughly digested and acrid, assumes mass and lastly induces flatus (वात).

A reciprocal action is noticed here between the food and the mucous membrane of the alimentary canal. This may be illustrated by taking an instance : The salivary flow is increased by sodium chloride partly through reflex action, and partly because some of it is excreted through the salivary glands ; and this excreted salt starts action again.

The sum and substance of the verses quoted above is as follows : Food, in its passage through the alimentary canal, is subjected to the action of (1) Kapha in the mouth and the stomach, (2) Pitta in the duodenum, the pancreas and the liver, and (3) Wata in the intestines, especially the large intestines, and the rectam.

Kledaka-kapha is connected with the first part of the alimentary digestion. SUSHRUTA clarifies this by stating औदकैः गुणैः आहारः प्रक्लिन्नसंघातः सुखजरश्च भवति ।

The physical properties of Kledaka-kapha serve the purpose of first moistening and then disintegrating the particles of the bolus, thus facilitating the action of gastric juice upon food. This action is, of course, more mechanical than

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chemical on account of the cooling (सौम्य) properties of Kapha. The nervous factors which come into play here are (1) Prana-vayu which co-operates with Kledaka-kapha and (2) Samana-vayu which co-operates with Pachaka-pitta, CHARAKA put it thus :

आहारपरिणामकरास्त्विमेभावा भवन्ति; तद्यथा—उष्मा पचति, वायुरपकर्षति, क्लेदः शैथिल्यमापादयति, स्नेहो मार्दवं जनयति, कालः पर्याप्तिमभिनिर्वर्तयति; समायोगस्त्वेषांपरिणामधातुसाम्यकरः सम्पद्यते ॥ १४ ॥

—च. शा. अ. ६

For explaination vide the article on SNEHANA in part II.

III. BODHAKA-KAPHA.

Bodhaka-kapha is defined by WAGBHATA as रसबोधनात् । बोधकोरसनास्थायी ।

Translation: The Kapha, which is located in tongue and which creates taste, is called Bodhaka.

This bears reference to the glandular secretions in and around the tongue. So far as the Wata element is concerned, it is the Prana-Vayu that plays its part prominently and is, therefore, the motive power. It is necessary that the reader acquires thorough acquaintance with the way in which all the salivary glands pour their secretions in the mouth. Bodhaka-kapha is the first secretion that comes in contact with food. It moistens the mouth and the tongue and helps the bolus of food to descend downwards. In this way it works hand in hand with Kledaka-kapha. Both these have a double function : a physical and a chemical. The conversion of starch into sugar is chemical action.

IV. TARPAKA-KAPHA.

Tarpaka-kapha is defined by WAGBHATA as

शिरःसंस्थोऽक्षतर्पणात् ॥ १७ ॥ तर्पकः

सू. अ. १२

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Translation: The Kapha which is situated in the head and which sustains the five sense-organs is called 'TARPAKA-KAPHA'.

Evidently WAGBHATA here explains the functions of Kapha which is apportioned to the brain and which has its Sthanas in the शिरस्. SUSHRUTA's definition is more clear and explanatory :

शिरस्थः स्नेहसंतर्पणाधिकृतत्वात् इन्द्रियाणामात्मवीर्येणानुग्रहं करोति।

It should be noted here that the seven tissues रस, रक्त etc. are incessantly undergoing chemico-physical changes automatically according to the requirements of the body. These phenomenal modifications are intimately connected with cell-metabolism. Some of the modern writers like Langley state that these changes occur through the medium of Autonomous Nervous Mechanism. So the tissue मज्जन् in the brain which is सोमगुणभूयिष्ट imparts स्नेह (कफधातु) to such parts of the body where fluidity, unctuousness and tenacity are necessary for protoplasmic functions. It is of different varieties such as आस्थिमज्जन्, मस्तकमज्जन् etc. and performs different functions in different localities. मस्तकमज्जन् here refers to शिरस्थकफ and has a double function, as it has to supply not only स्नेह to the different organs but also nervous energy, thus providing them with stability and equilibrium. SUSHRUTA also, while referring to the functions of the Seven Dhatus, describes मज्जन् as a source of affection, attachment, strength, nourishment of शुक्र, and the filling of bones with marrow.

Evidently, it is the inherent Kapha-dhatu in मज्जन् which imparts to the sense-organs the qualities mentioned above. So far as the functions of Tarpaka-kapha are concerned, it may be said that it serves both as a protective and a preservative in the case of the five sense-organs. A few instances may be quoted

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here to show how the sense-organs suffer when Tarpaka-kapha (involved) in मस्तकमज्जन् is deranged :

अस्थिदाहो भृशं मज्ज्ञि हारिद्र नख नेत्रताम् (when मज्जन् धातु is affected by excess of पित्त)

—हेमाद्रि टीका. सू. अ. ११/३६

मज्जगः शुक्लनेत्रत्वम्, (when मज्जन् is affected by excess of कफ)

— हेमाद्रि, टीका. सू. अ. १

मज्जा (अतिवृद्धः) सर्वांग नेत्र गौरवम् ।

—सु. सू. अ. १५

V. SHLESHAKA—KAPHA.

Shleshaka-kapha is defined by WAGBHATA as:

संधिसंश्लेषाच्छ्लेषकः संधिषु स्थितः ।

—सू. अ. १२

Translation: The Kapha which is situated in the joints and holds them together is called 'SHLESHAKA KAPHA.'

This, of course, refers to the synovial fluids which gets its share, like other secretions, from the formative fluids of the body.

Though the Tridoshas occupy the whole body, still these form chiefly the areas of their activity when they are unaffected by external or internal influences. Their movements constitute their functions in their individual capacity, working hand in hand—in harmony with one another.

इति प्रायेण दोषाणां स्थानान्यविकृतात्मनाम् ॥ १८ ॥
व्यापिनामपि जानीयात्कर्माणि च पृथक्पृथक् ॥

—वा. सू. अ. १२

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CHAPTER V

AYURVEDIC PATHOLOGY AND INVESTIGATION OF DISEASES

In the course of our discussions we have many a time traversed over the field of Pathology and stated how derangement in the function of any of the Tridoshas gives rise to disease. The methods of diagnosis adopted by the Ayurvedists, like those of the Western Medicine, depend upon the close observation of the patient, his mental and bodily conditions, environments and such factors as are necessary to understand the origin and progress of the disease. In this connection WAGBHATA says,

तस्माद्विकारप्रकृतीरधिष्ठानान्तराणि च ।
बुध्द्वा हेतुविशेषांश्च शीघ्रं कुर्यादुपक्रमम् ॥६६॥
दूष्यं देशं बलं कालमनलं प्रकृतिं वयः
सत्त्वं सात्म्यं तथाऽऽहारमवस्थाश्च पृथग्विधा ॥६७॥
सूक्ष्मसूक्ष्माः समीक्ष्यैषां दोषौषधनिरूपणे ।
यो वर्तते चिकित्सायां न स स्खलति जातुचित् ॥६८॥

—वा. भ. सू. अ. १२

Translation: Therefore, the physician should first consider the nature of the disease, the derangement caused in it by the doshas, the situations or the organs where the derangement, is manifested and the causes which are responsible for this derangement, and then begin to treat the disease. He who, during the examination of the patient, considers the conditions of the dhatus and the malas, the place of his residence, his strength and power of tolerance, the season of the ailment in question, the power of digestion, constitution and diathesis,

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the age , the mental state, the habits (likings) and idiosyncrasies, the food usually taken and other minute items related to the patient, and then arrives at a diagnosis and commences treatment, will never commit any mistake.

From this it will be clear that the foundations of rational therapeutics are almost the same in both the ancient and the modern systems of medicine. In Ayurveda, Satva, Satmya, Dosha and Dooshya have been looked upon with greater regard than in modern medicine. We have seen that the conception of the theory of 'Cause and Effect' has received greater importance not only from the evolutionary point of view, but also from the stand-point of practical medicine. The Tridosha Theory, which is made to conform to the Pancha-bhautika conception, is throughout used as the basis for the investigation of disease and therapeutics.

In pursuance of the definition of 'Life', Mind, the other side of the human constitution, has, from the earliest times, been rightly considered as a possible factor in the causation of disease. Rajas and Tamas are stated to be the causes of mental disturbance-disorder. Psycho-therapeutics had, therefore, long been in vogue in India. In modern times too, the significance of psychology and its relation to medicine has now been well recognised. In treatment, one has, therefore, to dive deep into the subconscious regions of the mind, in order to trace the course of the mental disorders. Consciousness (जागृति) is not an essential condition for the mental processes. Significant changes may go on in the mind of a person without his/her being conscious of them. It is in this subconscious region that the rootcauses of mental disorders lie.

It is on account of this that WAGBHATA insists on the necessity of the consideration of Satva along with Satmya, Dosha and Dooshya. Here Satva points to the state of the mind, Satmya to the susceptibilities peculiarities and tendencies, Dosha to the pathogenic factors and Dooshya to the changes in the primary seven tissues (Sapta-dhatus).

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The appearance of disease (आमय), as Ayurvedists have repeatedly stated, first takes place in the Adya-dhatu owing to the irregularities of food and drink, rest, exercise, variations in living etc. unless the rasa is contaminated or the dhatus contained in the rasa are disturbed by अयोग, अतियोग or मिथ्या-योग no disease can come into existence. This variation first manifests itself in the form of वृद्धि or क्षय in the सूक्ष्मावयवs of the dhatus concerned. The principle that underlies these processes has been enunciated as

वृद्धिः समानैः सर्वेषां विपरीतैः विपर्ययः ।

—वा. सू. भ. सू. अ. १

The dhatus of the body after getting nourishment from the different articles of food naturally assume the corresponding properties of the latter. There are, as CHARAKA points out,

तत्रेमे शरीरधातुगुणाः संख्यासामर्थ्यकरास्तद्यथा—गुरुलघुशीतोष्ण ॥१०॥

—च. शा. अ. ६

An excess or deficiency of these properties in the first place gives rise to दोषदुष्टि (diseased processes) and secondly to धातुदुष्टि (diseased structures) and स्थानदुष्टि (diseased organs). These three represent the pathology, morbid anatomy, and organic derangements respectively, CHARAKA says,

कार्ययोनिर्धातुवैषम्यं, तस्य लक्षणं विकारागमः ॥१४।३॥

—च. वि. अ. ८

NIDANA-PANCHAKA.

In Ayurveda, the Methods of Investigation of Diseases are usually described under the following five heads :

(a) निदान (Nidana), (b) पूर्वरूप (Poorva-roopa), (c) रूप (Roopa) (d) उपशय (Upashaya) and (e) संप्राप्ति (Samprapti).

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These are known as " निदानपंचक " where Nidana means " रोगनिश्चय "

(a) **Nidana:** Means the 'root-cause of the disease' and may be बाह्य (external), आभ्यंतर (internal), विप्रकृष्ट (remote), सान्निकृष्ट (immediate and hence exciting), प्राधानिक (primary), or व्यभिचारि (minor).

Nidana is brought about by

1. असात्म्येंद्रियार्थसंयोग- incompatible correlation of the senses with their objects i. e. transgression of the power of tolerance ; e. g. exposure to cold-causing nasal or pulmonary catarrh.

2. प्रज्ञापराध— Indiscretion in behaviour and irregularity in life.

3. External influences such as seasonal and climatic factors : अथैरसात्म्यैः संयोगः कालः कर्म च दुष्कृतम् ॥ ३५/१

—वा. भ सू. अ. १२

(b) **Poorvaroopa:** is suggestive of premonitary symptoms. The symptoms only suggest that some internal derangement has been started and that toxins are making their way towards the tissue-cells : दोषदूष्यसंमूर्च्छनावस्था. The affection is still undeveloped and does not evince any characteristics of a particular दोष (disease) : लिंगमव्यक्तमल्पत्वात् व्याधीनाम. It is a precursor of future tronble.

(c) **Roopa:** When the दोष developes there is a clear manifestation of subjective symptoms and physical signs. These signs and symptoms go by the names : रूप, लिंग, लक्षण, आकृति, संस्थान.

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(d) **Upashaya:** CHARAKA explains 'Upashaya' as सात्म्यार्थो हि उपशयार्थः in the eleventh chapter of Sootrasthana- and defines सात्म्य (Satmya) in the eighth chapter of Vimana; sthana as 'सात्म्यं नाम तद्यत्सातत्येनोपसेव्यमानमुपशेते'. Satmya is thus that property which, owing to a habitual use, develops adaptability. So, if a certain property in an article brings relief to a patient by removing the disturbing factor, it is said to be an 'Upashaya' of that derangement. सुखानुबंधो यो हेतुर्व्याध्यादिविपरीतकः (Sudant-Sen, Commentary, Madhava-Nidana) This is just like tracing the disease (cause) from the effect. In other words, it is an art–a device–of diagnosing by "applied therapeutics". CHARAKA advises this method of diagnosis when the दोष is अव्यक्त; for he says गूढलिंगं व्याधिमुपशयानुपशयाभ्याम् परीक्षेत ॥ १५ ॥

— च. वि. अ. ४

(e) **Samprapti:** means the knowledge of the way in which a certain disease develops. By knowing the Samprapti almost all the circumstances related to the development of a disease, whether arising from intrinsic or incidental causes, can be estimated.

The main features of Samprapti are described as संख्या विकल्प प्राधान्य बल काल विशेषतः — माधव निदान.

1. संख्या: (Samkhya)—the number of varieties or types in which diseases manifest themselves. This is, of course, only a general statement and hence does not give any idea of the particulars.

2. विकल्प (Vikalpa): दोषाणामंशांशकल्पना. This gives a correct idea of the direction in which the different दोष s (toxins) have developed. This is eventually of great value in 'Treatment'.

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3. प्राधान्य (Pradhanya) : Nature of the disease as to whether it is primary or secondary.

4. बल (Bala) : Severity or otherwise : (उत्तान-Uttana or गंभीर Gambheera)

5. काल (Kala) : Season, whether favourable or otherwise.

Next, the morbid phenomena which are ascertained by studying the क्रियाकाल (Kriyakala) in Samprapti are thus mentioned.

(i) संचय (Samchaya) : means the Accumulation of दोषs.

(ii) प्रकोप (Prakopa) : means Excitation.

(iii) प्रसर (Prasara) : means Extension of lesion.

(iv) स्थानसंश्रय (Sthanasamshraya) : means Location of the affection.

(v) व्यक्ति (Vyakti) Manifestation of Symptoms.

(vi) भेद (Bheda) : means Variation in the spread of the disease.

It is thus clear that all the details of ' Pathology ' are taken into consideration by the Ayurvedists in following these methods of diagnosis. Clinical descriptions of symtoms caused by pathological derangements in the दोषs and धातुs are given by Sushrut in the fifteenth chapter ot Sootrasthana and by WAGBHATA in the eleventh chapter of Sootrasthana.

In surgical pathology, naked-eye appearances characteristic of दोषs are minutely described in terms such as वर्ण, छाया, राग, दाह, पाक, कंडू, तोद, शोथ, कोथ etc. For details in this respect the reader is referred to the twentysecond chapter of Sootrasthana and first chapter of Nidansthana of SUSHRUTA.

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For the symptoms and pathological manifestations the reader should refer to the fifteenth chapter of WAGBHATA's Nidanasthana wherein detailed description of वातविकार (Vata-vikara) in the different आशयs (Ashayas), धातूs (Dhatus) and स्रोतस् (Srotas) is given. Similarly the derangements caused by Pitta and Kapha when they attack the सप्तधातुs (Sapta-Dhatus) and the symptoms which result are given in the nineteenth chapter of Sootrasthana of WAGBHATA's Ashtangasangraha. Both these deserve to be thoroughly mastered for the thorough understanding of the real part played by the दोषs in their vitiated condition in respect of their influence on the body-tissues.

The pathology of निज and आगंतुकरोगs is described according as they arise from intrinsic (धातुवैषम्य) and incidental (आगंतुक) causes respectively. Ayurvedists hold that even these आगंतुकदोषs, such as bacteria, have a constitution of their own which can be described in Tridosha terminology. These organisms have, after all, a material body which carries with it a type of Pancha-bhautika constitution. They grow under particular favourable conditions and die when the environment becomes unfavourable. The internal जंतुs are the resultant products of the Tridoshas, while the external have their origin in the environment. In treatment, importance is given to both types as they are likely to transgress their limites and encroach upon each other. CHARAKA has put this beautifully in the following words:

आगंतुरन्वेति निजंविकारं निजस्तथागंतुमपिप्रवृद्धः ॥१८॥

आगंतु (रोग) is defined by him in the next chapter as follows:

आगन्तुर्हि व्यथापूर्वं समुत्पन्नो जघन्यं वातपित्तश्लेष्मणां वैषम्यमापादयति, निजे तु वातपित्तश्लेष्माणः पूर्वं वैषम्यमापद्यन्ते जघन्यां व्यथामभिनिर्वर्तयन्ति ॥८॥ —च. सू. अ. २०

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Translation: In Agantu diseases affliction is the first occurence, and this is, in course of time, followed by derangement of the three doshas. In निजविकार Vata, Pitta and Kapha are first deranged by some internal pathogenic cause, and then the symptoms (like pain) follow.

In the opinion of the Ayurvedists, the internal bacteria are only the result of failure in equilibrium in the body-constitution caused by chemical products of bad digestion. The chief reason why the ancient physicians do not totally depend upon the Bacterial theory is because of the non-applicability of that theory in all diseases and in all individuals. They, therefore, while reserving the germ theory its own place in treatment, are not ready to assign to it an invariable position in the causation of disease. In short, the origin and cause of disease suggested in Ayurveda is placed on a broader basis. That the essence in both the systems, however, is one, can be made out from the following lines:

यदातु रक्तवाहीनि रससंज्ञावहानि च ।
पृथक्पृथक्समस्ता वा स्रोतांसि कुपिता मलाः ॥२५॥
मलिनाहारशीलस्य रजोमोहावृतात्मनः ।
प्रतिहत्यावातिष्ठन्ते जायन्ते व्याधयस्तदा ॥२६॥

—च. सू अ. २४

Translation: Diseases take place when toxins signly or collectively affect the lymphatics, blood vessels and the nerves in a person who takes insalutary food and has no control over his mind.

On studying the methods of Roga-pareeksha till now gone over, one should be able to estimate the extent of the virulence of the doshas or the disease itself. But there is another side of medical examination which is very important, and which, if neglected, would make all attempts at treatment useless. And this is 'आयुपरीक्षा', which means an approximate estimation

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of the state of natural resistance in an individual, both in normal as well as in the impaired conditions of health. It involves the investigation of various factors about the patient, viz., those connected with his nature, temperament, constitution hereditary influences, habit, environments etc. (For particulars vide Charaka, Vimana, Ch. 8.). These undoubtedly throw a flood of light on the prognosis of the case and enable the physician to choose remedies of a definite potency. CHARAKA has given detailed descriptions about the methods of understanding the personal constitution of the patient in the first chapter वर्णस्वरीय of इंद्रियस्थान. This part of investigation is often neglected both by students and vaidyas and it will be no exaggeration to say that no method of treatment would be complete and successful without a knowledge of personal vitality and power of resistance of a patient. असात्म्येन्द्रियार्थसंयोग, the first condition mentioned in the array of etiological factors points to the natural resistance of an individual to disease. In fact the first three stages, चय, प्रकोप and प्रसार, in the development of the disease are directly connected with the personal resistance of the patient. The question of tempering the virulence or checking the progress of the disease depends upon a clear understanding of the elementary factors in Samprapti. The significance of this, especially in treatment, is well expressed by WAGBHATA thus

चय एव जयेद्दोषं कुपितं त्वविरोधयन् ।
सर्वकोपं बलीयांसं शेषदोषाविरोधतः ॥ १५ ॥

— वा. भ. सू. अ. १३

Translation: An attempt should always be made to check the accumulation of toxins ; but when the toxins are already there, treatment should be so adopted, whether by means of dietary or medicines, that it does not provoke further complications. When all the three doshas are affected, one should aim at removing the affection which is more harmful or more advanced.

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The credit of bringing these elementary principles of pathology really falls to the share of Ancient Ayurvedists. Except through the agency of Tridosha theory or some other which is akin to it, it is not possible to understand the Samchaya stage in the Samprapti of a disease. There is no doubt that imagination has to be stretched and inferences drawn upon probabilities and possibilities. Even in laboratory-work much of imagination, discrimination and reasoning are required to arrive at conclusions. In research-work it is often found that theory and practice scarcely differ. The first directs the second, while the second confirms the truth of the first. CHARAKA expresses the same idea in the following words :

प्रत्यक्षं तु खलु तत्, यत् स्वयमिन्द्रियैर्मनसा चोपलभ्यते ॥ ५ ॥

—च. वि अ. ४

This sort of thought-sequence is necessary to understand the दोषदूष्यसंमूर्च्छनावस्था—the basis of Samchaya and to trace its development further and correlate the particular dosha with the particular prodromal symptoms.

TREATMENT:

It must first be noted that the unique feature of Ayurvedic treatment rests in the consideration not only of आयुपरीक्षा and व्याधिपरीक्षा, but also in the means and methods of application of medicines. CHARAKA at the very beginning of Sootrasthanas divides the whole subject of Ayurveda into two parts: 1. हेतुलिंगऔषधज्ञानम् and 2. स्वस्थातुरपरायणम्. हेतु and लिंग, which embrance Etilogy, Symptomatology and Pathology have already been gone over and the details of औषध will be treated in the following portion.

स्वस्थवृत्त i. e. attention to the personal well-being is looked upon with equal importance in Ayurveda along with Roga-Chikitsa. It forms part of the subject of medicine and is not treated as a different subject as in western system. स्वास्थ्य is defined as दोषसाम्यमरोगता and also as

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समदोषः समाग्निश्च समधातुमलक्रियः ।
प्रसन्नात्मेंद्रियमनाः स्वस्थ इत्यभिधीयते ॥४८॥

—सु. सू. अ. १५

Translation: 'Health' is defined as that condition of the body when the three doshas of a person are in equipoise, his power of digestion is normal, the dhatus and malayans are working properly, he is cheerful, his mind is undisturbed and his sensory organs are normal.

Equilibrium in the three doshas-the symbolic expressions of the three important stages of the body is a necessary factor for the maintenance of health. The words समाग्नि and प्रसन्नात्मेंद्रियमनाः are significant. In common practice, these do not receive so much attention as they deserve. In the case of treatment, Ayurvedists have given importance to प्रकृतिस्थापन and not restricted themselves to the cure of symptoms alone. If there is any speciality in the technique of treatment it is this devotion of attention to the restoration of health. Dosha-Samya constitutes the first consideration in treatment. This sententious word carries with it a world of meaning. For, the effective character of all the numerous forms of treatment finds a place in the realization of Dosha-Samya. CHARAKA says, एतावदेव हिभैषज्यप्रयोगे फलमिष्टं स्वस्थवृत्तानुष्ठाने च यावद्धातूनां साम्यं स्यात् ॥७॥

—च. शा. अ. ६

Translation: Maintenance of equilibrium in the three dhatus is the primary object intended in treatment; and maintenance of hygiene (स्वास्थ्य) also requires the same precaution, viz., Dhatu-Samya.

In order to attain these ends, Ayurvedists proposed the following methods of treatment. These are classified into two main groups:

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1. संतर्पण or बृंहण, 2. अपतर्पण or लंघन पार्थिव and आप्यद्रव्यs characterise the former, and आग्नेय, वायव्य and आकाशीय the latter. लंघन again consists of two forms, viz., शोधन and शमन. Of these शोधन can be accomplished by (a) वमन, (b) विरेचन, (c) शिरोविरेचन, (d) बस्ति and (e) अस्रविमोचन; and शमन can be accomplished by (a) पाचन, (b) दीपन, (c) क्षूत् (अन्नवर्जन) (d) तृट् (उदकवर्जन), (e) व्यायाम, (f) आतप and (g) मरुत्.

The whole list comprises the following forms:

1. बृंहण –Tonics.
2. स्नेहन –Protectives, Emolients & Demulcents,
3. स्तंभन –Astringents.
4. वमन –Emetics.
5. शोधन –Purgatives & Diuretices
6. नस्य –Sternutatories.
7. बस्ति –Enemata and Douchings.
8. अस्रविमोचन –Blood-letting.
9. शोधन –Diaphoretics.
10. शोषण –Absorbents.
11. पाचन –Digestives and Carminatives.
12. दीपन Stimulants; Respiratory, Cardiac, Nervine & Gastro-intestinal.
13. क्षुत् Fasting.
14. तृट् –Restriction of water.
15. व्यायाम Exercise.
16. आतप Fomentation.
17. मरुत् –Ventilation.

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The modes of therapeutic action included in these different forms of treatment fall under six heads :

(1) हेतुविपरीत corresponds to Rational.

(2) व्याधिविपरीत ,, ,, Symptomatic.

(3) हेतुव्याधिविपरीत ,, ,, Rational and Symptomatic.

(4) हेतुतदर्थकारी
(5) व्याधितदर्थकारी
(6) हेतुव्याधितदर्थकारी
These involve the principle 'Similia similibus curanteur.

The first three are clear enough and need no explanation. The remaining three form the basic principles of Homeopathy, where medicines which create the same condition as the disease, are used.

In Ayurveda and modern medicine the first three lines of treatment are chiefly used. In the former हेतुविपरीतचिकित्सा receives the closest attenttion, as Dhatu–Vaishamya whether brought on by Nija or Agantuka causes is the chief object for attack. Undoubtedly this subjective view of the Ayurvedists has a greater advantage over the objective methods of व्याधिविपरीतचिकित्सा, व्याधि is, after all, a symptom and may be produced by a number of causes. For instance, headache may be caused by derangement in any one of the three doshas. The right application of medicine would be to remove the cause first as it automatically removes the diseases also. In the treatment of acute diseases, such as fevers, this method is greatly useful. In chronic diseases as there is a jumble of symptoms brought on by व्याधिसंकर any one of the two or both have to be used There are, again, some diseases where the primary

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lession is not detected; in such cases, symptoms, which are after all the manifestations of the cause, require to be treated. SUSHRUTA explains this as

नास्ति रोगो विनादोषैर्यस्मात्तस्माद्विचक्षणः ।
अनुक्तमपि रोगाणां लिंगैर्व्याधिमुपाचरेत् ॥

In cases where there are sequalæ and complications great discretion has to be used in choosing the line of treatment. One has to meet the circumstances of the case and treat it accordingly. Because when the complication is severe and intolerable, it requires to be necessarily treated first. The instructions of WAGBHATA are very clear on this point. Vide Chapters 12 and 13 of Sootrasthana. Paliative and symptomatic lines have their own place in treatment and so cannot be neglected. Similarly a heroic line of treatment should not be adopted without a consideration of all the causative factors and their progress in the evolution of all the stages of disease. For, a natural elimination of toxins is always in operation on the part of the organism, and any attempt to disturb it is bound to be harmful. Vide verses 28, 29 and 30, Ch. 13 in Sootrasthana of WAGBHATA.

CLINICAL EXAMINATION.

The clinical examination in AYURVEDA is conducted with the knowledge given by I PRATYAKSHA. II. ANUMANA. III APTAWACHANA.

I प्रत्यक्ष (पंचभिःश्रोत्रादिभिःप्रश्नेन च)

II अनुमान.

III आप्तवचन.

I **Pratyaksha-Pareeksha** (प्रत्यक्षपरीक्षा) includes examination by the five senses and by asking direct questions to the patient or to his relatives.

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The following are the five senses used for **Pratyaksha-Pareeksha.**

(a) श्रोत्रेंद्रिय ग्राह्य	By hearing sounds, noises etc. and by marking the voice.
(b) स्पर्शनेंद्रिय ग्राह्य	By touching, feeling and manupulating with hand.
(c) चक्षुरिंद्रिय ग्राह्य	By seeing the various parts and noting the changes therein.
(d) रसनेंद्रिय ग्राह्य	(1) By judging the taste of the discharges, secretions and excretions as felt by insects such as ants, flies etc., (2) and by inquiry into the nature of the tongue and taste in the mouth.
(e) घ्राणेंद्रिय ग्राह्य	By smelling the discharges, excretions and breath.

These methods of examination are very important and can be learnt more by the bed-side of the patients than by reading descriptions. The details of Ashtavidha-pareeksha are mentioned in the books on medicine to which the reader should refer.

रोगाक्रान्तशरीरस्य स्थानान्यष्टौ परीक्षयेत् ।
नाडीं मूत्रं मलं जिव्हां शब्दस्पर्शदृगाकृतीः ॥

—नि. र. अ. वि. परीक्षा

Modern books contain detailed information on this most important subject and the students do well by referring to such books. The methods given in Ayurved are exactly anagolus to inspection, palpation, percussion, auscultation and mensuration as understood in modern literature. Since the advent of thermometer, the stethoscope, the microscope and various instruments for examining the eyes, ear, nose, throat, the stomach, the bladder, the rectum etc. much knowledge has been added to what could only be gained by old methods. Electricity

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especially has been of great use for the purposes of diagnosis and treatment. X-ray analysis, radiology, the electro-cardiogram, ultraviolet rays, ultramicroscopy, infra-red rays, photography, diathermy etc., have been all very important additions to the plain physical instruments, till now in use. Great advance in diagnostic radiology has been recently made. The radiologist visualises the biliary tract and the gall-bladder by means of certain chemical substances ; by injection of air he can out-line organs in the abdominal cavity and the sinuses in the brain. By the use of organic compounds of iodine he can make visible the lungs, the air-passages, the interior of the uterus, the spinal canal, the pelvis of the kidney and the urinary tract. Modern fluorescent screen enables digestive movements, heart beats or lung movements to be watched. It cannot be yet said how far physics can be of use to the development of the science of medicine in future. The Ayurvedists must move with the times and make use of the knowledge gained by these instruments for the elucidation of many unexplainable statements found in old literature.

Prashnenacha :

विजानीयाद्देशं कालं जातिं सात्म्यमातङ्कसमुत्थानं वेदनासमुच्छ्रायं बलमन्तरग्निं वातमूत्रपुरीषाणां प्रवृत्त्यप्रवृत्तीकालप्रकर्षादींश्च विशेषान् । आत्मसदृशेषु विज्ञानाभ्युपायेषु तत्स्थानीयैर्जानीयात् ॥ ५ ॥

—सु. सू. अ. १०

This examination by asking questions is extremely important again, as, by it, many of the doubts and difficulties met-with in the physical examination are removed, and direction for the line of treatment is indicated.

ANUMANA: अनुमानं नाम तर्कोयुक्त्यपेक्षः, यथोक्तं, अग्निं जरणशक्त्या, बलं व्यायामशक्त्या, श्रोत्रादीनि शब्दादिग्रहणेनेत्येवमादिः ॥ ६।३२ ॥

—च. वि. अ. ८

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ANUMANA means examination by inference. This involves descrimination between things noticed and association of ideas. All advance in knowledge must consist of both these operations; for, objects first appearing separately are brought together in the course of our observation. Analysis and synthesis are thus incessantly alternating mental activities without which no ordinary progress in the currency of thought is possible. Reasoning again is an important application of thought to arrive at conclusions, and to know essential and non-essential characters of occurences. CHARAKA has made reference to all these mental processes as they are necessary for the proper understanding of the case. The first chapter in SHAREERA-STHANA is very important in this respect to study a case and to arrive at a proper diagnosis. For the systematic method of case-taking, this examination is absolutely necessary. Even in the methods of examination by प्रत्यक्ष and आप्तवचन, अनुमान is necessary for discriminating and determinative purposes. For, in RASA-PAREEKSHA we have to depend upon what the patient says regarding the taste in his mouth, or we have to infer the condition of discharges from the way in which insects are attracted to them.

ANUMANA again has some scope when one has to judge the condition of the patient from his cravings, mental attitudes facial expressions and so on.

APTA-WACHANA तत्रोपदेशो नामाप्तवचनम्, आप्ता ह्यवितर्कस्मृतिविभागविदो निष्प्रीप्युपतापदर्शिनश्च ॥४॥

—च. वि. अ. ४

UPADESHA means the rules laid down by experienced clinicians without any restrictions such as formality, faddism or pre-possession. CHARAKA defines आप्तागम as the advice of disinterested persons whose judgement is well-founded, admitted by scholers and scrutinised by authoritative persons and

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whose word is only meant for the well-fare of humanity. परीक्षकैः प्रणीतः शिष्टानुमतो लोकानुग्रहप्रवृत्तः शास्त्रवादः स चाऽऽप्तागमः ॥२७॥

—च. सू. अ. ११

It must be noted here that the ancient Ayurvedists who wrote work on medicine, were well-versed in other sciences also such as logic, philosophy, grammar etc., and so their observations were based on truth and impartial judgement. Though they appreciated the principles laid down in other sciences, they accepted only such of them as would agree with the purposes of medical science. The adjustment of the PANCHA-BHAUTIKA theory and formulation of त्रिदोषसिद्धांत show this. They have similarly not blindly followed सांख्य, वैशेषिक, or न्यायदर्शन but have made such alterations as would suit their purpose. They were aware of the wide range of the ways of medical relief, and having kept their mind open to good-sense truth and justice welcomed all suggestions and deliberations for the sake of human welfare. It was with this object that संभाषापरिषत्s were arranged in olden times. CHARAKA's words in this connection deserve to be remembered:

न चैव ह्यस्ति सुतरामायुर्वेदस्य पारम्, तस्मादप्रमत्तः शश्वदभियोगमस्मिन् गच्छेत्, एतच्च कार्यमेवंभूयश्च वृत्तसौष्ठवमनसूयता परेभ्योऽप्यागमयितव्यम् ॥६।८॥

—च. वि. अ. ८

So, in other words, Apta-vakya does not only mean blind following but it also means authority proved by facts and tested by experience. In recent times, much is made of such therapeutics which is named 'inductive science' based on observation. Ayurveda does not only accept this, but goes further and makes use of deductive conclusion also, whenever necessary. Therefore treatment ought to be such that the

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application of the remedy should be faultless and not one sided. WAGBHATA says,

प्रयोगः शमयेद्व्याधिं योऽन्यमन्यमुदीरयेत् ।
नाऽसौ विशुद्धः शुद्धस्तु शमयेद्यो न कोपयेत् ॥१६॥

—अ. हृ. सू अ. १३

Translation: That medicine which temporarily alleviates symptoms, but may give rise to appearance of disease in some other situation, is not rational, i.e. based on correct principles. But such treatment is appropriate where the medicine modifies but does not at the same time provoke new complications.

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CHAPTER VI

AYURVEDIC PHARMACOLOGY.

As in the enunciation of the general principles of Tridosha-Pathology, so also in the conception of pharmacological principles, Ayurvedists have formulated certain general theories and classifications which involve the characteristic universal application of the Panchbhautika theory.

That the pharmalcoogical actions of drugs depend upon physical properties of the five divisions of matter has already been referred to under the heading of Tridosha. These five elementary principles in different combinations affect the human constitution in different ways. As it is impossible to calculate the strength of the particular principle in the several dravyas, Ayurvedists have, for practical purposes, divided them into five main divisions : पार्थिव, आप्य, तैजस्, वायव्य and आकाशीय according to the predominance of the particular Bhuta-dravya. To each of these again are attributed (1) the physical and chemico-physical properties, viz., Rasa and Guna, and (2) the physiological properties, viz., वीर्य, विपाक and प्रभाव known from the reaction of living matter to the drug-content. The nomenclature in the case of Rasa and Guna is certainly not arbitrary, as it may appear at first sight ; for CHARAKA says

न चैवमुक्ते द्रव्ये गुरुलाघवमकारणं मन्येत, लघूनि हि द्रव्याणि वाय्वाग्निगुणबहुलानि भवन्ति, पृथिवीसोमगुणबहुलानीतराणि ॥ ४ ॥

—च. सू. अ. ५

Translation : It should not be understood that the use of the words 'गुरु' (heavy) and 'लघु' (light) made in the description of dravyas is altogether unwarranted. Because in light articles the properties of vayu and agni predominate, and in heavy ones the properties of Earth and Water.

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It is clear from this that pharmacological properties are based on the reactions of living matter such as mucous membrane of the mouth respiratory tract, the stomach, intestines etc. The reader will find it easy to understand the कार्यकारणभाव implied in the conception of pharmacology by referring to the table already given under ' Tridosha '.

The Pharmacology of Drugs is discussed in general in Chapter I. We shall now take up the Pharmacological Properties which are discussed under the five headings-Rasa, Guna, Veerya, Vipaka and Prabhava—by the Ayurvedists.

रसs RASAS

The first of these, namely Rasa, is a comprehensive term and needs some explanation. It does not mean ' taste ' only as understood by the words " रसनार्थो रसस्तस्य "; it involves अनुरसs (anu-rasas) also which are detected by their effects on the system and which may not possess any taste. Pharmacologically, however, when its local action is taken into consideration, Rasa means " direct action of a drug on the nerve-endings in the mucous membrane of the mouth. " This action bears reference to the machanism by which all sapid substances stimulate the gustatory nerves by means of their chemical constituents. Though no fixed theory regarding the association of any basic or acid radicle in a compound body with the creation of taste, has yet been formulated, it may do, for the sake of illustration, if we take it that the acids own their characteristic taste to H ions in a compound, and that alkalies to their OH ions. Regarding the aliphatic sweet stuff Oertly and Meyers have worked out a theory, a brief description of which is given by Hugh McGuigan in his ' Chemical Pharmacology '. The inquisitive reader should refer to it.

Before we enter into details it is desirable to discuss the relative importance of Rasa as compared with the other properties of dravyas. In Ayurveda all dravyas, whether organic or

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inorganic, are classified into six groups in accordance with their Rasa-content. Rasa is taken as the basis, because it connotes a chemico-physical meaning. Dravya, of which Rasa is only a part, is a support for पृथिवी and अप् Bhutas of which Ap is the chief principle as it forms the source (योनिः) of the six Rasas. So Ap-tatva is a Karana-dravya and Rasa is a Karya-dravya. CHARAKA says. " तेषां षण्णां रसानां योनिरुदकम् ". He further continues to give reasons why only six rasas are to be considered in the evaluation of a dravya. CHARAKA says,

सौम्याः खल्वापोऽन्तरिक्षप्रभवाः पृकृतिशीता लघ्व्यश्चाव्यक्तरसाश्च, तास्त्वन्तरिक्षाद्भ्रश्यमाना भ्रष्टाश्च पंचमहाभूत गुणसमन्विता जङ्गमस्थावराणां भूतानां मूर्तीराभिप्रीणयान्ति, यासु मूर्तिषु षड्भिमूर्च्छन्ति रसाः ॥३७॥

—च. सू. अ. २६

Translation: The Apa-tatva, which has descended to earth through आकाश (Akasha), has its source in सोम (Soma). It is, therefore, cool and light by nature, and at the beginning of creation its rasa is unmanifest, when, on its way downwards through Akasha, it is influenced by the properties of the Pancha-mahabhutas, it affects all the movable and immovable objects in the world, and thus it is that objects are endowed with the six rasas arising from the union.

These quotations indicate the physical constitution and the evolutionary source of rasas. The combinations of Ap and Prithivee are innumerable. Only some of them contain Vyakta-rasas, while the others Avyakta-rasas or anu-rasas. The former are recognised immediately by the organ of taste, and the latter by their action on the constitution. WAGBHATA says, तत्र (रसनेन्द्रियस्य) व्यक्तोरसः । अनुरसस्तु रसेनाभिभूतत्वादव्यक्तो-व्यक्तो वा किंचिदन्ते ॥

To complete the explanation that rasa has a comprehensive range of action CHARAKA states,

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रसनार्थो रसस्तस्य द्रव्यमापः क्षितिस्तथा ।
निर्वृत्तौ च विशेषे च प्रत्ययाः खादयस्त्रयः ॥६२॥

—च. सू अ. १

Translation: Rasa is the sense of taste residing in the tongue. पृथिवी and जल are its sources of development. The manifestation of Rasa depends upon the properties of Akasha, Vayu and Taijas, and so too the creation of difference in taste (Rasa).

The Vyakta-Rasas are only six. The A-vyakta-rasas are many. Hemadri is sufficiently clear on the differentation between Rasa and Anu-rasa. He says, तत्रद्रव्ये, कश्चिद्धर्मः सद्योव्यक्तः; कश्चिदव्यक्तः; कश्चिदीषव्यक्तः; कश्चिदन्तेव्यक्तः । तेषु आद्योरसाख्यः, इतरे त्रयोऽनुरसाख्याः ॥

Thus are formed the six rasas. The predominance of the elementary principles in each of them is given here below:

Name of Rasa.				Origin of Rasa.
1. मधुर	—	Madhura	—	भूम्यंबुबाहुल्यात्
2. अम्ल	—	Amla	—	भूम्यग्निबाहुल्यात्
3. लवण	—	Lavana	—	तोयाग्निबाहुल्यात्
4. कटु	—	Katu	—	वाय्वाग्निबाहुल्यात्
5. तिक्त	—	Tikta	—	वाय्वाकाशबाहुल्यात्
6. कषाय	—	Kashaya	—	पृथिव्यनिलबाहुल्यात्

It must be noted here that it is the gunas of the Mahabhutas which represent the rasas, and not the Mahabhutas themselves. Dravya is only a common factor. In this connection SUSHRUTA says,

जन्म तु द्रव्यरसयोरन्योन्यापेक्षिकं स्मृतम् ।
अन्योन्यापेक्षिकं जन्म यथास्याद्देहदेहिनोः ॥ —सु. सू. अ.

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Translation: The relation between Rasa and Dravya (its support) is the same as that between the body and the soul ; for they are both interdependent.

The rasas and anu-rasas are in all sixty-three. As to the formation of these the reader is referred to Table No. VII given elsewhere.

On account of the chemical significance which Rasa carries with it, Ayurvedists have adopted it as a standard for the classification of all drugs. The other properties of dravyas cannot satisfy this purpose. Guna by itself is only a physical property, and being indefinite, it cannot be a unit for classification ; Veerya is described in terms of Guna, but it works through Rasa, for CHARAKA says,

पाको नास्ति विना वीर्यात् वीर्यं नास्ति विना रसात् ।

—च. सू. अ.

Vipaka is virtually a rasa having undergone a transformation by digestive processes; and lastly, Prabhava is a specific property. Hence the importance of Rasa both in Therapeutics and in the classification of drugs.

In short,

1. Rasas produce a direct or/and immediate action, and the Anu-rasas an action which is not manifest.

2. The rasas have particular reference to the feeling of taste.

3. They produce an action on the mucous and synovial membranes, and even on the skin through the nerves.

4. The local action of Rasas is availed of in therapeutical measures such as Snehana, Swedana, Nasya, Basti etc.

The shad-rasas —षड्रसाः —The six Rasas.

रसाः स्वाद्वम्ललवणतिक्तोषणकषायकाः ।
षड् द्रव्यमाश्रितास्ते च यथापूर्वं बलावहाः ॥१४॥

—अ. हृ. सू. अ. १

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TABLE SHOWING RASAS AND ANURASAS IN DRAVYAS.

TABLE No. VII

S. No.	मधुर	अम्ल	लवण	तिक्त	कटु	कषाय
१	म					
२		अ				
३			ल			
४				ति		
५					कटु	
६						क
७	म	अ				
८	म		ल			
९	म			ति		
१०	म				कटु	
११	न					क
१२		अ	ल			
१३		अ		ति		
१४		अ			कटु	
१५		अ				क
१६			ल	ति		
१७			ल		कटु	
१८			ल			क
१९				ति	कटु	
२०				ति		क
२१					कटु	क
२२	म	अ	ल			
२३	म	अ		ति		
२४	म	अ			कटु	
२५	म	अ				क
२६	म		ल	ति		
२७	म		ल		कटु	
२८	म		ल			क
२९	म			ति	कटु	
३०	म			ति		क
३१	म				कटु	क
३२		अ	ल	ति		
३३		अ	ल		कटु	

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S. No.	मधुर	अम्ल	लवण	तिक्त	कटु	कषाय
३४		अ	ल			क
३५		अ		ति	कटु	
३६		अ		ति		क
३७		अ			कटु	क
३८			ल	ति	कटु	
३९			ल	ति		क
४०			ल		कटु	क
४१				ति	कटु	क
४२	म	अ	ल	ति		
४३	म	अ	ल		कटु	
४४	म	अ	ल			क
४५	म	अ		ति	कटु	
४६	म	अ		ति		क
४७	म	अ			कटु	क
४८	म		ल	ति	कटु	
४९	म		ल	ति		क
५०	म		ल		कटु	क
५१	म			ति	कटु	क
५२		अ	ल	ति	कटु	
५३		अ	ल	ति		क
५४		अ	ल		कटु	क
५५		अ		ति	कटु	क
५६			ल	ति	कटु	क
५७		अ	ल	ति	कटु	क
५८	म		ल	ति	कटु	क
५९	म	अ		ति	कटु	क
६०	म	अ	ल		कटु	क
६१	म	अ	ल	ति		क
६२	म	अ	ल	ति	कटु	
६३	म	अ	ल	ति	कटु	क

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Translation: Rasas belonging to dravyas are six in number. They are मधुर, अम्ल, लवण, तिक्त, उषण (कटु) and कषाय. The first is highly potent, while the others are proportionately less potent in a descending order.

The Physiological Properties of Rasas:

मधुररसः :— मधुरो रसो रसरक्तमांसमेदोऽस्थिमज्जौजः शुक्रस्तन्यवर्धनश्चक्षुष्यः केश्यो वर्ण्यो बलकृत्सन्धानः शोणितरसप्रसादनो बालवृद्धक्षतक्षीणाहितः षट्पदपिपीलिकानामिष्टतमस्तृष्णामूर्च्छादाहप्रशमनः षडिन्द्रियप्रसादनः कृमिकरश्चेति ॥१२॥

अम्लरसः :— जरणः पाचनः दीपन पवनानिग्रहणोऽनुलोमनः-कोष्टविदाही बहिःशीतः क्लेदनः प्रायशोहृद्यश्चेति ॥१३॥

लवणरसः :— लवणः संशोधनः पाचनो विश्लेषणः क्लेदनः शैथिल्यकृदुष्णः सर्वरसप्रत्यनीको मार्गविशोधनः सर्वशरीरावयवमार्दवकरश्चेति ॥१४॥

कटुरसः :— दीपनः पाचनः रोचनः शोधनः स्थौल्यालस्यकफकृमिविषकुष्ठकण्डूप्रशमनः संधिबन्धविच्छेदनोऽवसादनः स्तन्यशुक्रमेदसामुपहन्ता चेति ॥१५॥

तिक्तरसः :— छेदनो रोचनो दीपनः शोधनः कण्डूकोठतृष्णामूर्च्छाज्वरप्रशमनः स्तन्यशोधनो विण्मूत्रक्लेदमेदोवसापूयोपशोषणश्चेति ॥१६॥

कषायरसः :— संग्राहको रोपणः स्तम्भनः शोधनो लेखनः शोषणः पीडनः क्लेदोपशोषणश्चेति ॥१७॥

—सु. सू. अ. ४२

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Relation of Rasas with the other properties and their action on Tridoshas:

TABLE No. VIII

रस	गुण	वीर्य	विपाक	ACTION ON TRIDOSHA	
मधुर	गुरु	शीत	मधुर	श्लेष्मवर्धक	वातपित्तहर
अम्ल	लघु	ऊष्ण	अम्ल	पित्तवर्धक	वातहर
लवण	गुरु	ऊष्ण	मधुर	पित्तकफवर्धक	वातहर
कटु	लघु	ऊष्ण	कटु	वातपित्तवर्धक	कफहर
तिक्त	लघु	शीत	कटु	वातवर्धक	पित्तकफहर
कषाय	गुरु	शीत	कटु	वातवर्धक	कफपित्तहर

गुणः GUNAS.

Gunas act by means of physical as well as chemical properties. Logically, being part of dravyas, they are responsible, though in an abstract sense, for all action in drugs in whatever way and through whatever channel the latter are prescribed. Dravyas are a समवायिकारण (samavayi-karana) in action on account of the existence of guna and karma in them. Dravya is, therefore, आश्रय, and Guna is आश्रयी. CHARAKA has put this concisely in the following stanza: The ideas are akin to those of Nyaya-Vaisheshika philosophy

यत्राश्रिताः कर्मगुणाः कारणं समवायि यत् ।
तद्द्रव्यं समवायी तु निश्चेष्टः कारणं गुणः ॥ ५० ॥

—च. सू. अ. १

Translation: That substance, in which both guna and karma are indissolubly united and which is a Samavayi-karana,

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is 'Dravya'. And that, which forming a part (Samavayee) can only be a Karana but which is incapable of independent action, is a Guna.

They, therefore, act mechanically and their action is due to their chemico-physical properties resting in dravyas. They are twenty in number according to the Ayurvedic writers. The gunas mentioned in the article on Tridosha (in this Part) are in accordance with the Vaisheshika philosophy.

The gunas mentioned in Ayurved are

गुरुमन्दहिमस्निग्धश्लक्ष्णसान्द्रमृदुस्थिराः ।
गुणाः ससूक्ष्मविशदा विंशतिः सविपर्ययाः ॥१८॥

—अ. ह. सू. अ. १

GUNAS:		ACTION:	
1. गुरु	- Heavy	1. बृंहण	- Tonic.
1. लघु	- Light	1. लाघव	- that which creates lightness and activity.
2. मंद	- Dull, slowly acting.	2. शमन	- which passifies,
2. तीक्ष्ण	- Sharp, active	2. शोधन	- which cleans.
3. हिम, शीत	- Cooling	3. स्तंभन	- which condenses.
3. उष्ण	- Heating	3. स्वेदन	- which induces perspiration.
4. स्निग्ध	- Oily, soothlng	4. क्लेदन	- which produces moisture.
4. रूक्ष	- Harsh, drying	4. शोषण	- which dries.
5. श्लक्ष्ण	- Smooth	5. रोपण	- which stimulates growth.

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GUNAS:		ACTION:	
5. खर, परुष	– Rough and harsh, Coarse.	5. लेखन	– which rarefies, attenuates.
6. सांद्र	– Thick, dense	6. प्रसादन	– which nourishes.
6. द्रव	– Liquid	6. विलोडन	– which dissolves or mixes.
7. मृदु	– Soft	7. श्लथन	– which relaxes.
7. कठिन,कर्कश	– Hard, acting strongly	7. दृढीकरण	– which fastens, hardens, solidifies
8. स्थिर	– Non-mobile	8. धारण	– which supports.
8. सर, चल	– Mobile,	8. प्रेरण	– which produces motion or action, which excites.
9. सूक्ष्म	– Penetrating, thinning	9. विवरण	– which penetrates, analyses.
9. स्थूल	– Fattening, Bulky	9. संवरण	– which covers or protects.
10. विशद	–Transparent, Clear.	10. क्षालन	– which clears.
10. पिच्छिल	–Slimy, Gelatinous.	10. लेपन	– which forms a coating.

Additional gunas such as आशु–quickly diffusing or quickly acting–व्यवायि– which spreads over the whole body without undergoing digestion–and विकाशि– which quickly spreads over the whole body and depresses the spirit, e. g., betel-nut irritation–are mentioned by some : but Ashu and Vikasi are implied by तीक्ष्ण and Vyavayi by सर.

Five out of these properties are more important. With regard to them BHAVA-PRAKASHA says,

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लघुर्गुरुस्तथास्निग्धोरूक्षस्तीक्ष्ण इतिक्रमात् ।
नभोभूवारिवातानां वन्हेरेते गुणास्मृताः ॥

They are arranged in the form of a table so that the relation of the dravyas with their properties can be readily understood.

GUNA.	DRAVYA.	KARMA.
1. लघु	आकाशीय	पथ्य, कफकर, शीघ्रपाकी
2. गुरु	पार्थिव	वातहर, चिरपाकी, पुष्टिकृत्, श्लेष्मकृत्.
3. स्निग्ध	आप्य	श्लेष्मकृत्, वातहर. वृष्य, बलवह
4. रूक्ष	वायवीय	वातकृत्, कफहर
5. तीक्ष्ण	तैजस	पित्तकर, लेखन, कफहृत्, वातहृत्

वीर्य -VEERYA.

Regarding Veerya CHARAKA says,

रसो निपाते द्रव्याणां, विपाकः कर्मनिष्ठया ।
वीर्यं यावदधीवासान्निपाताच्चोपलभ्यते ॥६८॥

—च. सू. अ. २६

Translation: Rasa manifests itself immediately when it comes in contact with the tissues (tongue), and Vipaka at the end of digestion. But Veerya is noticed sometimes immediately, as in the case of पिप्पली, and sometimes after the drug has remained and acted in the system for some time.

Veerya means strength. This strength is obtained by a drug through the gunas residing in it. These gunas give it special strength which distinguishes it from other properties, such as Rasa, Vipaka and Prabhava. CHAKRAPANI's definition of Veerya:

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वैद्यके हि रसविपाकप्रभाव-व्यतिरिक्ते प्रभूतकार्यकारिणि गुणे "वीर्यं" इति संज्ञा.

is quite clear and gives us the real technical meaning of the word. CHARAKA's definition also is not far away from this, for he says,

.....वीर्यं तु क्रियते येन या क्रिया ।
नावीर्यं कुरुते किंचित्सर्वा वीर्यकृता क्रिया ॥६७॥
—च. सू. अ. २६

Here, capacity for action is assigned to Veerya, by means of which it accomplishes the object for which treatment is adopted. Rasa and Vipaka indicate the means, and Veerya and Prabhava the specific object wherewith the choice of a drug is made in treatment. The word क्रिया used in CHARAKA's definition, therefore, points to an action in the plan of treatment.

SUSHRUTA's words एतानि खलु वीर्याणि रसमभिभूय स्वबलगुणोत्कर्षात् आत्मकर्म दर्शयन्ति ॥५॥ —सु. सू. अ. ४०

also show that Veerya is superior to Rasa.

वीर्यसंख्या -Forms of Veerya.

It has been said that the Veerya of a drug gets its properties from the gunas residing in it. Some Ayurvedists describe Veerya as consisting in eight forms, and some in two forms only: CHARAKA says,

मृदुतीक्ष्णगुरुलघुस्निग्धरूक्षोष्णशीतलम् ।
वीर्यमष्टविधं केचित्केचिद्द्विविधमास्थिताः ॥६६॥
शीतोष्णमिति वीर्यं तु क्रियते येन या क्रिया ॥६७।१॥
—च. सू. अ. २६

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But as, ultimately, the eight properties mentioned in the first line of above quotation can be accommodated in two properties-शीत and उष्ण. The latter classification is, therefore, adopted for practical purposes. WAGBHATA gives in the following lines the reasons why only two forms of Veerya are sufficient to express the meaning :

नानात्मकमपि द्रव्यमग्निषोमौ महाबलौ ॥ १७ ॥
व्यक्ताव्यक्तं जगदिव नातिक्रामति जातुचित् ॥ १८/१ ॥
—अ. हृ. सू. अ. ९

Translation: Though bodies are made up of complex elements they cannot remain untouched by either one or the other of the two properties of the all-powerful factors-Heat and Cold-just as the world consisting of many things, manifest or unmanifest, cannot exist without (the influence of) Agni and Soma, the primal principles.

Further to show how such a classification into उष्णवीर्य and शीतवीर्य is useful in the interpretation of the actions of drugs, WAGBHATA gives definitions of उष्ण and शीत in the following words :

तत्रोष्णं भ्रमतृड्ग्लानिस्वेददाहाशुपाकिताः ॥ १८ ॥
शमं च वातकफयोः करोति, शिशिरं पुनः ।
ल्हादनं जीवनं स्तम्भं प्रसादं रक्तपित्तयोः ॥ १९ ॥
—अ. हृ. सू. अ. ९

Translation: उष्णवीर्य drugs cause giddiness, thirst, languor, sweating, heat and capacity for quick digestion. They also reduce Vata and Kapha. शीतवीर्य drugs, on the other hand, are soothing and nourishing, and have tendency to cause condensation of tissues by controlling excessive secretion and also to regulate Rakta and Pitta dhatus by modifying the intensity of circulation.

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Summary: Veerya, therefore, when it acts as an independent factor among the properties of dravyas, may be said to mean the systemic effect produced when the drug has had sufficient time to act and when the metabolic processes in the alimentary canal have reached such a stage that either a heating or a cooling effect is produced. This systemic effect is eventually brought about by the combined influence of the nervous and the digestive mechanisms. These effects are more lasting and may, therefore, be comparatively named "abiding actions." It may be said, therefore, that the action of drug on the body is due to the influence of their Veerya. So, while Rasa and Vipaka are measured by the strength of their action on the alimentary canal, Veerya is measured by its abiding action on the system, as a whole. It is possible, again, that Veerya-pradhana drugs may give rise to cumulative action if given for a longer time.

The relations between Rasa and Veerya are described by WAGBHATA as follows:

रसाः कटुम्ललवणा वीर्येणोष्णा यथोत्तरम् ॥ ३६ ॥
तिक्तः कषायो मधुरस्तद्वदेव च शीतलाः ॥ ३७/१ ॥
—अ. हृ. सू अ. १०

Translation: The Rasas-Katu, Amla and Lavana - have higher degrees of heat in the ascending order ; similarly, Tikta, Kashaya and Madhura have higher degrees of cold in the same order.

विपाक -VIPAKA.

WAGBHATA defines Vipaka as

जाठरेणाग्निना योगाद्यदुदेति रसान्तरम् ।
रसानां परिणामान्ते स विपाक इति स्मृतः ॥२०॥
अ. हृ. सू. अ. ९

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Translation: The transformation of Rasa, after food is digested completely in the gastro-intestinal tract—by means of digestive juices, is called Vipaka.

In Ayurved the process of digestion is described as taking place in two ways. One of these wavs bears reference to the stages of digestion which takes part in the successive parts of the alimentary canal. The other is with reference to the end-result following the completion of digestion. The first is exactly similar to the way in which the processes of digestion in the different tracts are interpreted in modern physiology. It is indicative of the influence of the local juices, such as the saliva, the gastric juice and succus Entericus, on the food whatever its रसघटकs may be. It is called अवस्थापाक in Ayurveda as we shall see later on from the description given by CHARAKA. The second is called निष्ठापाक which is a विशिष्ठपाक and indicates the combined effect of all the digestive juices on the food ingested. Because, the end-result is the outcome of absorption and elimination and depends upon factors related both to the chemical nature of the food and to the predominant strength of the digestive juices at work. It can be inferred from the total effect on the constitution produced by the digestive processes. There is no doubt that there can be some exceptions to such conclusions as conditions vary in different individuals according to their digestive power. Therefore, Ayurvedists have adopted a general way in mentioning the number of the Vipakas. They are three, viz., Katu, Amla and Madhura.
Charaka says,

कटुतिक्तकषायाणां विपाकः प्रायशः कटुः ।
अम्लोऽम्लं पच्यते स्वादुर्मधुरं लवणस्तथा ॥५०॥

—च. सू. अ. २६

The Vipaka of Katu, Tikta and Kashaya rasas is Katu.
,, ,, ,, Amla rasa..... ,, Amla.
,, ,, ,, Madhura and Lavana rasas ,, Madhura.

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CHARAKA gives the following reasons for such a classification:

मधुरो लवणाम्लौ च स्निग्धभावात्त्रयो रसाः ।
वातमूत्रपुरीषाणां प्रायो मोक्षे सुखा मताः ॥६१॥
कटुतिक्तकषायास्तु रुक्षभावात्त्रयो रसाः ।
दुःखाय मोक्षे दृश्यन्ते वातविण्मूत्ररेतसाम् ॥६२॥
शुक्रहा बद्धविण्मूत्रो विपाको वातलः कटुः ।
मधुरः सृष्टविण्मूत्रो विपाकः कफशुक्रलः ॥६३॥
पित्तकृत्सृष्टविण्मूत्रः पाकोम्लः शुक्रनाशनः ।
तेषां गुरुः स्यान्मधुरः कटुकाम्लावतोऽन्यथा ॥६४॥

—च. सू. अ. २६

Translation : The three rasas, Madhura, Amla and Lavana, on account of their unctuous and moistening properties, are regarded as useful in facilitating the expulsion of flatus and the excretion of urine and faeces. The coarse and irritating properties of Katu, Tikta and Kashaya rasas, on the contrary, cause discomfort at the time when the excreta and semen are discharged.

Katu-Vipaka	hinders the production of semen, causes flatulence, constipation and dysuria, on account of its irritating properties.
Madhura-Vipaka	helps the discharge of urine and faeces, induces secretion of Kapha and creates reproductive power.
Amla-Vipaka	causes biliousness, helps the excretory functions and destroys reproductive power.

Of these three Vipakas, Madhura-Vipaka is said to be

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गुरुपाक (Gurupaka) i.e वातपित्तघ्न, and Amla and Katu vipakas are लघुपाक (Laghupaka) i.e. श्लेष्मघ्न. (Cf. Sushruta, Sootra-sthana Ch. XXI).

It may appear to the reader that the classification of Vipakas into the three निष्ठापाकs (Nishtha-pakas) is superfluous. In fact it is not so. For, Nishtha-paka is dependent on the result of the three regional अवस्थापाकs (Avastha-pakas). Chakradatta has made it clear in his commentary (CHARAKA, SOOTRA-STHANA, Ch. 26). He says,

त्रिधा विपाकस्तु रसमलविवेकसमकालो भिन्नकाल एवावस्थापाकैः सममिति न विरोधः । स च भिन्नकालोऽप्यवस्थापाककार्यदोषानुगुणतयाऽननुगुणतयावा अवस्थापाकाहितदोषाणां वर्धनं क्षपणं वा करोतीति तस्याभिधानं शास्त्रे प्रयोजनवदेव ॥

Translation: There can be no contradiction in saying that the end-result, Nishhta-paka, which is produced when the transformation of food into Rasa and Mala is complete, is the same as the Avastha-pakas. Because, though the stages and the timings of the two Vipakas are different-the one being at the end and the other during the intervals of digestive processes-the endresult (Nishtha-paka), whether it be acceleration or retardation (reduction) of the pharmacological actions of the drugs used, is exactly in proportion to the pharmacological effects of the intermediary regional Avastha-pakas.

CHARAKA summarises this in the following words:

विपाकलक्षणस्याल्पमध्यभूयिष्ठतां प्रति ।
द्रव्याणां गुणवैशेष्यात्तत्र तत्रोपलक्षयेत् ॥६५॥

—च. सू अ. २६

Medicines, like articles of food, undergo modification in the mouth, stomach and intestines, which is in proportion to their potency and the power of absorption in the different areas.

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Now, it remains to say what these Avastha-pakas are and why they are particularly named after the 'Tastes'- Madhura, Amla and Katu. CHARAKA explains this in ग्रहणीचिकित्सा Chapter XV.

(a) **Digestion in the Mouth:** (by Kapha)

अन्नस्य भुक्तमात्रस्य षड्रसस्य प्रपाकतः ।
मधुरात्प्राक् कफोद्भवात्फेनभूत उदीर्यते ॥७॥

(b) **Digestion in the stomach and the Duodenum:** (by Pitta).

परंतु पच्यमानस्य विदग्धस्याम्लभावतः ।
आशयाच्च्यवमानस्य पित्तमच्छमुदीर्यते ॥८॥

(c) **Digestion in the Intestines:** (by Vata).

पक्वाशयं तु प्राप्तस्य शोष्यमाणस्य वन्हिना ।
परिपिण्डितपक्वस्य वायु स्यात्कटुभावतः ॥९॥

—च. चि. अ. १५

Before we proceed to the explanation of these verses it is necessary to go over a few physiological facts regarding the reflex actions which take place in the mouth and the stomach after the entry of food.

It must first be noted that secretion occurs in two stages: the first depending upon the sense of taste while the food is yet in the mouth, and the second occuring after the food reaches the stomach. The first is mechanical and of a nervous origin. The character of the secretion which is poured out varies, however, greatly with the diet which excites it. The second, which is chemical, depends more or less upon the difference in the structure of the glands. The mechanical secretion induced by the presence of food contains a purely mucous fluid whether it is in the mouth or in the stomach. The first earlier

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portion of the gastric secretion is almost alkaline but as the structure of the glands in the stomach varies the chemical nature also varies. The first secretion induced by the mechanical or nervous agencies may therefore be called Bodhaka or Kledaka Kapha while the latter secretions Pachaka-Pitta. The first is mucous and alkaline and owes its semichemical character to the earlier secretions in the stomach before the glands in the fundus and the pylorus have had time to act. The second owes its acidity to the chemical processes in the mucous membrane of the fundus and the pylorus. So, appetite and sense of taste are the first stimulating agents in the secretory functions started by the nervous impulses; later on they are continued by chemical stimuli which act as long as there is food in the stomach.

Explanation of the three verses quoted above:

1. In the first it is clearly mentioned that food consisting of six rasas primarily induces secretion of sweetish frothy juice (Kapha) which surrounds the bolus externally and causes it to slide down more easily through the fauces and oesophagus It is possible that the word 'Kapha' has some significance in so far as it bears reference to the peculiar action of the chemical constituents of saliva.

2. The food prepared in the mouth is conveyed by Prana-vayu (the excito-motor force) to the stomach where it is further subjected to general trituration and to the solvent action of the gastric juice which is clear, thin and acid (Amla) in reaction. The word 'विदग्ध' has reference to the acid nature of the half-digested contents of food, which are now ready for their passage into the next portion of the alimentary canal, namely, duodenum. Chakradatta translates 'विदग्ध' as पक्वापक्व, because part of the contents (starch) is dissolved in the mouth and part (albuminous) is broken by the pepsin of the gastric juice in the stomach ; a third portion, that of the fatty elements, remains to be digested yet. When food reaches the duodenum it is acted upon by bile and

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the pancreatic juice which further check the acid action of the gastric juice and enable the fatty contents to get emulsified by the alkaline principles of the bile and pancreatic juice. Compare the following from SUSHRUTA :

षष्ठी पित्तधरा नाम पक्वामाशयमध्यस्था । सा ह्यन्तरग्नेरधिष्ठानतयामाशयात् पक्वाशयोन्मुखमन्नं बलेन विधार्य पित्ततेजसा शोषयति पचति पक्वं च विमुंचाति ॥

—अष्टांग स. श. अ. ५

Translation: The sixth कला by name पित्तधरा, being situated in the region between आमाशय and पक्वाशय which is the seat of active digestion, takes hold of food as it comes down in the direction of small intestines, absorbs it by means of its पित्त secretion, assimilates the digested portion and releases the remaining.

The part 'अग्न्यधिष्ठान' in the text is ग्रहणी according to the definition :

अग्न्यधिष्ठानमन्नस्य ग्रहणाद्ग्रहणी मता ॥ ५३ ॥
नाभेरुपरि सा ह्यग्निबलोपस्तंभबृंहिता ॥
अपक्वं धारयत्यन्नं पक्वं सृजति पार्श्वतः ॥ ५४ ॥

—च. चि. अ. १५

These descriptions by WAGBHATA and CHARAKA go to show that the digestive processes connected with Amla-vipaka take place in the stomach as well as in the Duodenum and a greater part of the small intestines. It is quite necessary for the reader to study these ayurvedic descriptions along with the parallel portions concerning digestion from the modern physiology.

When food reaches the small intestines it is in the form of pulp called 'chyme' and is further acted upon by intestinal

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juice. This juice is capable of dissolving the albuminous and starchy contents of the food which have escaped the solvent action of the stomach and the duodenum. The food thus being continually digested is gently propelled by the peristaltic contractions of the intestines along their interior wall, and it is at the same time pressed against the numerous villi that project from the mucous membrane of the small intestine. The fluid of the chyme is, for the most part, absorbed by the blood-vessels; while the molecular material passes from the epithelial cells through the basement membrane of the villi and finds its way into the chyle-ducts; from the chyle-ducts it is further conveyed to the lymphatic glands. The passage of the molecular matter from the chyme into the epithelial cells is due to endosmosis assisted by the mechanical pressure exercised by the muscular walls of the intestines. Compared to the metabolic processes in the stomach and the duodenum, the intestinal action is but mechanical as it is mainly concerned with absorption. Though much fluid is absorbed in the small intestines, an almost equal quantity is secreted again by the mucous membrane to keep the contents of the remaining portions of the chyme in a liquid condition.

3. In the large bowel, the onward passage of the food is delayed and so greater portion of the absorption of water occurs there; the contents, therefore, become more solid and assume form. Cf:

पुरीषधराकला

यकृत्समन्तात् कोष्ठं च तथान्त्राणि समाश्रिता ।
उण्डुकस्थं विभजते मलं मलधरा कला ॥ १७ ॥

— सु. श. अ. ४

The nervous force, which causes this muscular action and helps the analysis of food and its transfer from one place to another, is termed as 'Samana-vayu'. Its functions are described by SUSHRUTA as follows:

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आमपक्वाशयचरः समानो वह्निसङ्गतः
सोऽन्नं पचति तज्जांश्च विशेषान्विविनक्ति हि ॥ १६ ॥
पक्वाधानालयोऽपानः काले कर्षति चाप्ययम् ॥१८/१॥
समीरणः शकृन्मूत्रशुक्रगर्भर्तवान्यधः ॥१९/१॥

—सु. नि. अ. १

Translation: Samana-vayu, which is supplied to the gastro-intestinal tract, in association with the heat produced during digestive processes, digests and analyses food and separates the rejectable products from the wholesome ones.

Apana-vayu, situated in पक्वाधान (lumbo-sacral region), helps the punctual elimination of the excreta, the regular secretion of seminal and menstrual discharges and the timely expulsion of the foetus. Now a summary of the detailed processes of digestion as given in Modern Physiology is set forth here for the benefit of the students.

The Processes of Digestion as given in Modern Physiology :

The act of swallowing consists of three stages : The first of these is in the Mouth and is voluntary. The second stage is in the Pharynx which is a reflex action, rapidity being necessary, as the pharynx is common to both respiration and alimentation. The third stage begins when the constrictors of the pharynx are drawn over the food-bolus, which is thus forced into the oesophagus. Peristaltis begins here and it is induced by the vagus and the local nervous mechanisms. The saliva is intimately mixed with the bolus, and the enzyme diastase or amylase splits starch into maltose and dextrin.

STOMACH : The nervous action is regulated by (i) the efferent vagus fibres which accelerate and augument the movements, and (ii) the sympathetic fibres that inhabit peristalsis.

The food is held in the stomach until provision is made for the continuance of gastric secretion, until the gastric juice has

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had time to act, and until the food can carry with it the acid needed for the processes in the duodenum. But as water excites no gastric secretion it begins to leave the stomach almost as soon as it enters. The slow discharge of fats from the stomach is explained by the fact that not only do they inhibit secretion there, but when they begin to be digested in the duodenum they give rise to fatty acids which will help to keep the pylorus closed. Consequently they leave only as fast as they are absorbed by the small, or carried to the large, bowel.

The pylorus opens a few minutes after a meal. Normally, the greatest movement takes place in the pyloric portion. The stomach is completely emptied in three hours, though there are variations depending upon the type of the meal. Hydrochloric Acid on the gastric sides of the pylorus opens the Sphincter, but on the duodenal side it leads to its closure.

Chemical Processes : (i) Hydrochloric acid activates pepsin. Proteins are converted by pepsin into soluble diffusible peptones. (ii) Cane-sugar is inverted by the acid into glucose and fructose. (iii) Fats are split up. (iv) Putrifactive organisms are destroyed by the acid. (v) Salivary digestion of starch is continued for some time in the stomach. (vi) Practically, no absorption occurs except in the case of volatile articles.

Duodenum : The chyme passes out of the stomach with an acid -reaction and its undigested constituents are subjected to a second process of digestion by an alkaline fluid which is a mixture of bile and pancreatic juice. The enzymes of the pancreatic juice split up proteins, convert starch into maltose and dextrin, and fats into glycerine and fatty acids. Bile is an important aid to the pancreatic juice in the digestion of fats. The bile-salts promote absorption of fats by lowering the surface-tension of the intestinal contents and by dissolving fatty acids. Further, bile precipitates unpeptonised protein, augments colonic peristalsis and lessens intestinal putrefaction.

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The muscular movements of Duodenum are partly progressive and partly churning. The movements of the duodenum and the contractions of the gall-bladder are augmented by the vagus and inhibited by the Sympathetic.

The main absorption of the products of the gastric and pancreatic digestion commences in the duodenum and is continued in the small intestine.

Liver : The substances which enter the liver through the portal veins consist of the products of digestion, viz.,

(1) Protein molecules broken up into amino-acids, (2) Salts, (3) Traces of fat and (4) Abundant Water and (5) Glucose.

Surplus amino-acids are hydrolysed by the hepatic cells. The nitrogenous portion is formed into urea ; and the non-nitrogenous returns to the blood to serve as a source of energy.

All sugars are absorbed as mono-saccharides. They are stored in the liver and muscles as Glycogen. Glycogen, according to the requirement, is transformed into sugar by means of liver-diastase, and also into fat and gluco-protein. The decomposition can be increased by the glycogenolytic nerves (splanchnic).

Fats and Acids : Fats are first stored in the adipose tissue ; when utilised, the ferment lipase in the connective tissue liberates glycerol and fatty acids and these latter are carried to the liver cells, where there are formed simpler fatty acids, such as, caproic and butyric which can be normally oxidised by the tissues into carbonic acid and water.

Bile-its Secretion and Function: Bile is formed in response to the chemical stimulus of 'secretin'. Bile-pigment results from the decomposition of Haemoglobin. The pigments, bilirubin ($C_{16}H_{18}N_2O_3$) and biliverdin ($C_{16}H_{20}N_2O_5$), are purely excretory. But the important secretory constituents of bile are the bile-salts, Sodium Taurocholate and Sodium

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Glycocholate. The salts are reabsorbed from the bowel, carried back to the liver, there to be synthetized again into cholates which are once more secreted, and discharged into the bowel. So bile-salts move in a circle comprised by (1) the Ducts, (2) Gall bladder, (3) Intestines, and (4) the portal Vein.

Bile is thus both a secretion and an excretion. The liver is an important agent in detoxication and in maintaining the constant composition of blood. Just as on the metabolic side it co-operates with pancreas, so on the haemolytic side it co-operates with the spleen.

The Intestines: Here, to a greater extent than in the duodenum, food comes into contact with the intestinal bacteria by which (1) Carbohydrates are converted into lactic, butyric and carbonic acids, (2) Cellulose into gases of flatulence, (3) Proteins are reduced to phenol-derivatives, and (4) Fats to butyric and valeric acids.

So the contents acquire for a period an acid reaction which is again reconverted to alkaline by the ammonia-producing organisms in the lower-bowel.

Absorption of food commences in the duodenum but is mainly accomplished in the Jejunum and Ileum. Absorption is not purely a matter of osmosis; but it is to a large extent a selective action of the epithelium, in which action the underlying leucocytes may play a part.

Proteins are absorbed in the form of amino-acids, and these are resynthetized into animal-tissue-proteins or de-aminated in the liver.

Carbohydrates are converted into mono-sachharides and then absorbed. Proteins, carbohydrates, salts and water are taken up into the portal circulation, the rate of absorption depending upon (1) the rapidity of intestinal circulation (2) the osmotic tension of the intestinal contents as compared with blood-plasma and (3) the condition of the absorptive mucous membrane.

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Fats: These after being split into glycerine and fatty-acids are absorbed by the epithelium of the intestines; they are then synthetized into fat and transferred to the lacteals. By the time the intestinal contents have reached the colon the digestive products are mainly absorbed.

Excretion: Excretion is very active in the small intestine and the contents are liquid. The watery secretions are separated from the blood partly by osmosis from the vessels, partly by the glands in secreting succus entericus and mucus. The intestinal epithelium also excretes poisonous materials, such as heavy metals alkaloids and toxins.

In the large intestines absorption of food-residue continues still, and during the slower transmission of the contents more water is absorbed and the faeces become formed. The consistency of the faeces depends upon (1) the activity of absorption (2) activity of excretion (3) and rate of transit. Diarrhoea depends upon diminished absorption and excessive secretion. Constipation is due to active absorption and diminished secretion.

Transit of contents of food in the small intestine is effected by peristalsis, which is a result of co-ordinated reflex action, the centres being in the ganglion-cells of "Auerbach's Plexus". Normally peristalsis is brought about by stimulus of food and activity by muscular exercise emotions and sensations. The vagus and the sympathetic, through the splanchnic, exert a control over the "Auerbach's plexus", the former stimulating and the latter inhibiting peristalsis. In the colon the nervus Erigens acts instead of vagus. Food takes four and a half hours to reach the coecum and about eighteen hours to reach the rectum.

Effects of Evacuation of bowels. :—

(1) Water is removed from the circulation.

(2) Bile is swept out and liver is stimulated.

(3) Abdominal circulation is modified.

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(4) Blood circulates freely through the liver and portal system.

(5) Heart and vessels are relieved.

(6) Blood-pressure falls.

(7) Cerebral circulation is diminished.

(8) Respiratory movements become easier.

(9) Temperature may fall.

(10) Circulation through the kidneys is increased.

Fate of proximate Principles of food.

During the course of digestion, these food-principles which are eleven in number (see the chemical characters of drugs under part II) are acted upon by bacteria, yeast, enzymes and other heat-producing chemical agents and are converted into pure chemicals of simpler composition, such as paraffins alcohols, ethers, acids colloids etc. These latter act upon the tissues of the body either directly through the medium of cells through the nerves, or through the blood circulation. Those that are easily oxidised are absorbed and even re-synthetized again (in some cases) in the body. Those that are bland inert and insoluble are excreted by the intestines along with the excess of secretionary matter accumulated there. Water and the soluble salts pass out chiefly through the urinary route. The force or energy which is spent in life-processes comes from the latent energy stored up in plants, which on convertion becomes kinetic. The hydrocarbonaceous and nitrogenous principles evolve heat and force respectively during oxidation. After the drugs have passed through the liver and the intestines they are carried first of all to the right side of the heart, thence to the lungs ; and there many volatile substances may be eliminated. From the lungs the blood along with the drugs contained in it, gets into the left side of the heart, and from that onwards into the Aorta. There, as the first branches of the Aorta are the coronary arteries, the drug is carried through these branches into the heart-muscle itself: so the heart itself is one of the organs that first receives any drug that is travel-

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ling through circulation. The other organs receive their portions of the drugs subsequently. The most important point that should be borne in mind in this connection is the wide influence of the drug on the nervous system owing to the extensive character of its area. The drug also passes through the muscles and to the various secreting glands and thence it passes out through the secretions of the latter.

PRABHAVA.

Definition :—

रसवीर्यविपाकानां सामान्यं यत्र लक्ष्यते ।
विशेषः कर्मणां चैव प्रभावस्तस्य च स्मृतः ॥ ६९ ॥
— च. सू. अ. २६

Translation: This is the power in the drugs which acts specifically and therefore which enables us to discriminate between drug and drug, when the other properties namely रस, वीर्य, विपाक, are common.

It is called specific action and is always found to be a characteristic of that drug which possesses it. For instance दंती and चित्रक are similar in रस, गुण, वीर्य and विपाक, but their specific actions are different from one another. The first is a purgative while the second is a stomachic. Similarly, ghee and milk which though possessing the same रस, वीर्य and विपाक are differing in their specific actions. There is no other way to ascertain their properties except by actual test in a laboratory. The पांचभौतिक theory is unable to give us any satisfaction in such cases. The Ayurvedists were aware of this and so have left instructions to posterity so that it may be guided by experimental conclusions than by theory only. SUSHRUTA say,

सहस्रेणापि हेतूनां नाम्बष्ठदिर्विरेचयेत् ।
तस्मात्तिष्ठेत् तु मतिमानागमे न तु हेतुषु ॥६९॥
—च. सू. अ. ४०

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In consideration of the many difficulties coming in the way of a correct explanation of Drug-Pharmacology by the Arambhaka theory only, the Ayurvedists had to speak of Prabhava as अचिंत्य. In view of the exceptions met with in the practical application of drugs, it is clear that the mode of action cannot be understood. Having recognised this fact, the Ayurvedists divided drugs into two types : (a) समानप्रत्ययारब्ध and (b) विचित्रप्रत्ययारब्ध. The pharmacological action of the former can be explained by the physical or chemical constitution of the drugs, as understood by the words Guna, Rasa and Veerya, because these are ruled by general laws applicable to the majority of drugs, in whose case the therapeutical actions are readily understood ; e. g.,

उष्णस्निग्धौ वातघ्नौ ; शीतमृदुपिच्छिलाः पित्तघ्नाः; तीक्ष्णरूक्षविशदाः श्लेष्मघ्नाः

But in the case of the latter, the action cannot be easily explained as there are many exceptions to the primal law (Arambhaka Nyaya). CHARAKA has admitted this by his words

तस्माद्रसोपदेशेन न सर्वं द्रव्यमादिशेत् ।
दृष्टं तुल्यरसेऽप्येवं द्रव्ये द्रव्ये गुणान्तरम् ॥५४॥

—च. सू. अ. २६

because

किंचिद्रसेन कुरुते कर्म पाकेन चापरम् ॥ २२/२ ॥
गुणान्तरेण वीर्येण प्रभावेणैव किंचन ॥२३॥

—अ. हृ. सू. अ. ९

Even the alkaloidal medication, or 'active principles' therapeutics cannot claim to explain the Prabhava-tatva of drugs. There is no doubt that the active principles have helped to widen the range of remedial measures ; for, many drugs, whose active principles are not known, may remain unused. But the alkaloids do not form a well defined group in a rational

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classification of organic compounds. They are usually complex substances with different groupings for their base. No classification of alkaloids has yet been possible on account of their variation in their chemical behaviour. Some of them have been classified after the 'names' of the drugs, such as, Aconite-alkaloids, Veratrum-alkaloids, Strychnine-alkaloids, and so on. There are some, again, whose composition is unknown. So their therapeutical value cannot be estimated by one common principle. Individually considered, the strength of some drugs, therefore, lies sometimes in Rasa and Veerya, sometimes in Prabhava and sometimes in Dravya as a whole. Having appreciated these peculiarities in drugs, CHARAKA first enunciates, for all practical purposes, a general law applicable to regularly constituted drugs. He says, तत्र खल्वनेकरसेषु द्रव्येष्वनेकदोषात्मकेषु च विकारेषु रसदोषप्रभावमेकैकत्वेनाभिसमीक्ष्य ततोद्रव्यविकारप्रभावतत्त्वं व्यवस्येत् ॥ ९ ॥

— च. वि. १

Translation: As it is possible that dravyas possess many rasas and that diseases are accompanied with many doshas, one should take into consideration the individual strength of each rasa in the dravya, and of the dosha in the disease, and then calculate the Prabhava of both i.e., the reaction of the one against the other.

And, then to solve the difficulty in the case of irregularly constituted drugs, he observes तथायुक्ते हि समुदाये समुदायप्रभावतत्वमेवमेवोपलभ्य ततो रसद्रव्यविकारप्रभावतत्वं व्यवस्येत् ॥११॥ तस्माद्रसप्रभावतश्च द्रव्यप्रभावतश्च दोषप्रभावतश्च विकारप्रभावतश्च तत्त्वमुपदेक्ष्यामः ॥१२॥

—च. वि. अ. १

Translation: When, in a medicinal compound used in treatment, there are a number of rasas differing from one another and complexly constituted, one should take a collective

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view of the composition of the compound and then estimate the efficacy of the rasas, dravyas and vikaras.

It is no wonder, therefore, if Ayurvedists have said 'प्रभावोऽचिंत्यएवच'. The lastest addition of Chemotherapy to modern Materia Medica explains this very well.

It now remains to explain the application of these pharmacological properties of plants in therapeutics. The physiological actions of rasas and veeryas have already been discussed. To explain the physiological action of gunas as being useful in treatment, CHARAKA mentions six general methods of treatment which comprise almost all the factors necessary for the cure of diseases :

I. लंघन

Definition : यत्किंचित् लाघवकरं देहे तत् लंघनंस्मृतम् ।

Note: Veerya and Guna required to make a लंघनद्रव्य are :

लघूष्णतीक्ष्णविशदं रूक्षं सूक्ष्मं खरं सरम् ॥ १२ ॥
कठिनं चैव यद्द्रव्यं प्रायस्तलंघनं स्मृतम् ॥ १३ ॥

च. सू. अ. २२

II. बृंहण

Definition : बृंहत्वं यच्छरीरस्य जनयेत्तच्च बृंहणम् ।

Note : Veerya and Guna required to make a बृहंणद्रव्य are

गुरुशीतमृदुस्निग्धं बहलं स्थूलपिच्छिलम् ॥ १३ ॥
प्रायो मंदं स्थिरं श्लक्ष्णं द्रव्यं बृंहणमुच्यते ॥ १४/१ ॥

—च. सू. अ. २२

III. रूक्षण

Definition : रौक्ष्यं खरत्वं वैशद्यं यत्कुर्यात् तद्विरूक्षणम् ।

Note: Veerya and Guna required to make a रूक्षणद्रव्य are:

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रूक्षं लघु खरं तीक्ष्णमुष्णं स्थिरमपिच्छिलम् ॥१४॥
प्रायशः कठिनं चैव यद् द्रव्यं तद्धि रूक्षणम् ॥१५।१॥

IV. स्नेहन

Definition : स्नेहनं स्नेहविष्यंदमार्दवक्लेदकारकम् ।

Note: Veerya and Guna reqnired to make a स्नेहनद्रव्य are:

द्रवं सूक्ष्मं सरं स्निग्धं पिच्छिलं गुरु शीतलम् ॥१५॥
मन्दं मृदु च प्रायो यद्द्रव्यं तत्स्नेहनं मतम् ॥

V. स्वेदन

Definition : स्तंभगौरवशीतघ्नं स्वेदनं स्वेदकारकम् ।

Note: Veera and Guna required to maka a स्वेदनद्रव्यs are:

उष्णं तीक्ष्णं सरं स्निग्धं रूक्षं सूक्ष्मं द्रवं स्थिरम् ।
द्रव्यं गुरु च यत्प्रायस्तद्धि स्वेदनमुच्यते ॥१६॥

VI. स्तंभन

Definition : स्तंभनं स्तंभयति यद्गतिमंतं चलं ध्रुवम् ।

Note: Veerya and Guna required to make a स्तंभनद्रव्य are:

शीतं मंदं मृदु श्लक्ष्णं रूक्षं सूक्ष्मं द्रवं स्थिरम्
यद्द्रव्यं लघु चोद्दिष्टं प्रायस्तत्स्तंभनं स्मृतम् ॥१७॥
—च. सू. अ. २२

CLASSIFICATION :

Following this conception of the actions and the uses of drugs Ayurvedists have classified the plants as follows :

(1) मधुरादिवर्ग -Pharmacologically—CHARAKA, Vimana-sthana, Ch. 8.

(2) शोधनादिगण -Therapeutically, —SUSHRUTA, Sootra-sthana, Ch. 43.

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(3) Pharmacologically, therapeutically, and from their actions upon the different organs.	SUSHRUTA, Sootrasthana, Ch. 38. CHARAKA, ,, Ch. 4.

Strong and Poisonous Drugs : Drugs of a poisonous nature have long been in use in India. Some of these are mentioned in the Nighantus, and their pharmacological descriptions also given. Plant-poisons are generally named 'स्थावरविष' as differentiated from 'जंगमविष' which are animal-poisons. Just as in the case of metalic-poisons, poisonous drugs are subjected to a vigourous process of purification before they are used. Ayurvedists have attached great importance to संस्करणविधि in the use of drugs of a poisonous nature. The importance of this has been pointed out by CHARAKA in Ch. XII-Kalpa-Sthana where he says,

अल्पस्यापि महार्थत्वं प्रभूतस्याल्पकर्मताम् ।
कुर्यात्संयोगविश्लेषकालसंस्कारयुक्तिभिः ॥ ४६ ॥

—च. कल्प. अ. १२

Methods of purification (Shodhana) are given in the descriptions of such drugs under their respective headings.

In a pharmacological sense Visha is defined by SUSHRUTA as

रूक्षमुष्णं तथा तीक्ष्णं सूक्ष्ममाशु व्यवायि च ॥ १९ ॥
विकाशि विशदं चैव लघ्वपाकि च तत् स्मृतम् ॥
तद्रौक्ष्यात् कोपयेद्वायुमौष्ण्यात् पित्तं सशोणितम् ॥
मतिं च मोहयेत्तैक्ष्ण्यान्मर्मबन्धान् छिनत्ति च ॥
शरीरावयवान् सौक्ष्म्यात् प्रविशेद्विकरोति च ॥ २१ ॥
आशुत्वादाशु तद्धन्ति व्यवायात् प्रकृतिं भजेत् ॥

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क्षपयेच्च विकाशित्वाद्दोषान्धातून्मलानपि ॥ २२ ॥
वैशद्यादतिरिच्येत दुश्चिकित्स्यं च लाघवात् ।
दुर्हरं चाविपाकित्वात्तस्मात् क्लेशयते चिरम् ॥ २३ ॥
— सु. कल्प अ. २

It is interesting to note the characteristic way of Ayurvedists in describing the pharmacology of poisonous drugs, where they do not swerve an inch from the Pancha-bhautika basis common to all drugs-dravyas.

Poisons are described as consisting of two varieties, viz., Vishas- विष and Up-vishas-उपविष. The number of plants containing these poisons is stated to be eighteen in the Nighantu Ratnakar. Out of these, nine are used in medicine. They are :

कालकूटो वत्सनाभः शृंगकश्च प्रदीपकः ।
हालाहलो ब्रम्हपुत्रो हरिद्रः सक्तुकस्तथा ॥
सौराष्टिक इति प्रोक्ता विषभेदा अमी नव ॥

The botanical description of only Vatsanabha - वत्सनाभ (Aconite) which forms one of these is known. The others are not identified.

Plants containing Up-Vishas are :

विषतिन्दुकबीजं च त्वहिफेनं च रेचकम् ।
धत्तूरबीजं विजया गुञ्जा भल्लातकह्वयः ॥ १६४ ॥
अर्कक्षीरं स्नुहिक्षीरं लांगली करवीरकम् ।
समाख्यातो गणोऽयं तु बुधैरुपविषाभिधः ॥ १६५ ॥
—र. त. तरंग ३४

The list given in Nighantu-Ratnakara is a little different from the above :

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स्नुह्यर्कलाङ्गलीगुञ्जाहयारिर्विषमुष्टिका ।
जेपालोन्मत्ताहिफेनं नवोपविषजातयः ॥

—नि. र. उ. वि. प्र.

Almost all of these are mentioned in the section on 'Alkaloids and Glucosides' in the second part of this book.

A few drugs of a poisonous nature, met with in Ayurvedic practice, are given below for the information of the reader.

(a) Irritants :

1. विष — Aconitum Ferox.
2. विषमुष्टि — Strychnos Nux-Vomica.
3. लांगली — Gloriosa Superba.
4. गुंजा — Abrus Precatorious.
5. जयपाल — Croton Tiglium.
6. काकादनी — Asclepias Curassiania.
7. करवीर — Nerium Odorum.
8. नागदमनी — Crinum Asiaticum.
9. दान्ति — Baliospermum-Montana.
10. स्नुहि — Euphorbia Antiquorum.
11. निवडुंग — Euphorbia Neriifolia.
12. पार्वतएरंड — Jatropha Curcus.
13. कटुतुंबी — Lagenaria Vulgaris.
14. इंद्रवारुणी — Citrullus Colocynthus.
15. देवदाली — Luffa Echinata.
16. कोशातकी — Luffa Amara.
17. मदन — Randia Dumetorum.
18. अर्क — Calotropis Gigantia.

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(b) Narcotics:

1. उन्मत्त — Datura Alba.
2. विजया — Cannabis Indica.
3. अहिफेन — Papaver Somniferum.
4. काकफल — Anamirta Paniculata.
5. पारसिकयमानी — Hyoscyamus Nigra.

Also refer to SUSHRUTA's Kalpasthana Ch. II art. 5.

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PART II

CHAPTER I

Introduction : MATERIA MEDICA, in its widest sense, is a science which treats of the natural history, sources, characters, chemical composition, methods of preparations, actions, and uses of drugs. It, therefore, includes the following branches :

1. Materia Medica Proper or Pharmacognosy, as it is otherwise called, is the science which constitutes the knowledge of the natural history. physical characters, and chemical composition of drugs.

2. Pharmacy is the science and art of the preparation and combination of drugs so as to render them fit for use.

3. Pharmacology or Pharmacodynamics is the science which treats of the actions of drugs on the body, its organs, the senses, and the elementary principles in health.

Toxicology is the science which treats of the effects of proportionately large doses of drugs which may endanger, or prove harmful to life.

4. Therapeutics treats of the application of drugs in diseases. This may be either (a) rational or (b) empirical or symptomatic as when the effect is known from clinical experience only.

General Therapeutics is a branch of therapeutics and treats of the relief of diseases not only by drugs but also by such accessory remedies as change of climate, regulation of diet, rest, exercise, baths, massage, and the like. Charaka

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includes under this head दैवव्यपाश्रय, युक्तिव्यपाश्रय, सत्वावजय as given in article 63, Chapter 11 सूत्रस्थान

दैवव्यपाश्रयं – मंत्रौषधिमणिमंगलबल्युपहारहोमनियम प्रायश्चित्तोपवास स्वस्त्ययन प्रणिपात तीर्थगमनादि ; युक्तिव्यपाश्रयं – पुनराहारौषधद्रव्याणां योजना ; सत्वावजय–पुनरहितेभ्योऽर्थेभ्यो मनोविनिग्रहः ॥ ६३ ॥

GENERAL THEORIES REGARDING ACIONS OF DRUGS.

Drugs may act topically on the parts of the body to which they are applied, on the distant parts by reflex action through the nerves, and by selective affinity between the drug and tissues. The fact that the entire circulation is accomplished in about half a minute goes to show that any active drug circulating through the blood produces its effect very rapidly. Drugs may be said to have a prompt action as in the case of poisonous remedies, and to have local or limited action as in the case of common pharmacopeial agents. The poisonous remedies are, more or less, protoplasmic poisons as they tend to destroy cell contents, and the common pharmacopeial agents consist of drugs which seem to have special affinity for variously differens tiated protoplasms ; some therefore act when applied directly on the nerves, others on the alimentary canal, and a third class on the blood. In the living body, however, activity of circulation is necessary for the operation of the remedies, and it is observed that whenever it is too languid from exhaustion or other causes they fail to operate. It is further observed that by whatever channel a drug. with characteristic properties, is introduced in the system whether by the stomach, rectum, skin or lungs, the effect is the same exactly as if it was introduced into the blood itself. It follows, therefore, that the active principles of a drug are first absorbed into the blood and then act upon the different tissues, exalting or diminishing their functions, in consequence of a property of attraction and selection exerted by the molecules of the tissues themselves. In this respect the drugs act in the same way as the articles of diet do. In this connection Bruce in his " principles of

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Treatment" writes "Food is not a mere matter of feeding or giving nourishment in disease. It is to be employed as a means of treatment, at once powerful and delicate, calculated not merely to nourish tissues, but to produce immediate specific and remote effects of a perfectly definite and natural character, on the different organs of the body, just like the different medicines. Beginning with its admission in the mouth and ending in the elimination of its product by the different organs of excretion, food possesses a remarkable number and variety of Physiological actions (digestive, absorptive, excretory, propulsive, and thus influencing the organs concerned) in respect of kind, form, amount and the frequency with which it is given. So potent a means of treatment (for good or for bad) ought to be intelligently handled in obedience to clearly defined indications. When a practitioner is deliberately planning treatment he should think of the food to be given in each case, as he should do so in the case of drugs." In virtue of vital powers, therefore, one tissue attracts and selects from the blood fat, another albumen, and a thrid mineral matter-or one gland attracts the substance which it forms into urea, and so on. The tissues concerned, therefore, attract and select from the blood the peculiar property of one drug and another tissue that of a different one. This theory accounts also for the degrees and varieties of disordered function produced by different types of drugs. The existence of such property in drugs, or more strictly speaking, in the living tissues, to which (through the blood) parts of these drugs are carried in solution, are ultimate facts in the science of therapeutics. At the same time it may be understood that in a few cases impressions made upon the extremities of sensitive nerves act according to the laws of reflex action, as when counter-irritants relieve internal pain or when sternutatories induce sneezing. The study of these facts must ever furnish the proof that all exact explanation and knowledge of the action of drugs must spring from physiological investigation.

It has generally been supposed that if one drug exalts action and another depresses it, the effects produced by the first

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may be counteracted by the second. But this does not always follow. For example, strychnine evidently excites motor-nerves to action, and Curari as certainly paralyses them. As remedies, however, the one has no counteracting effect on the influence of the other. Similarly, examples may be quoted where the therapeutic actions of drugs, being of an uncertain value, have falsified experimental conclusions. The ineffectiveness of opium in delirium Tremens for inducing sleep and of tea and coffee to cause wakefulness in opium-poisoning points to the possible conclusion, viz. that each drug has an affinity for particular nerve-cells. It is, therefore, not always possible to explain exactly through what route drugs produce their effects on the system. A parallel idea is found in Ayurvedic works:

रसेन वीर्येण गुणैश्च कर्म द्रव्यं विपाकेन च यद्विदध्यात् ।
सद्योऽन्यथा तत् कुरुतेप्रभावाद्धेतोरतस्तत्र न गोचरोऽस्ति ॥

—अष्टांग संग्रह अध्याय १७

The processes of life both in animals and vegetables are governed by the chemical and physical phenomena controlled by nerve-force which is well developed in the former but is rudimentary in the latter. Ayurvedists have, however, tried to explain that the selective action of drugs is not quite so arbitrary as it appears, but that it subserves panchabhautika (telluric) influences or other forces of nature which control all physiological and chemico-physical activities in animals and vegetables.

MODERN THEORIES REGARDING THE ACTION OF "DRUGS"

(A) **Chemical and Physical Action:** As all drugs are broken up in the body and the liberated constituents produce various actions on the different organs of the body, one can infer that the physiological action of a drug often depends upon its chemical constitution. Changes unaccountable also result, and it is often difficult to separate these from the purely chemical. The intensity of the action of a drug depends upon

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what is called the chemico-physical condition. That the physical condition must obviously be influenced by the pharmacological action is but natural as it can be observed from the action of a volatile, non-volatile, light, heavy (not essily broken down and hence difficult to be assimilated), fatty non-fatty and such other substances. In fact the action is determined by (a) the atomic and molecular arrangement, (b) the rate of rapidity at which the drugs are broken up in the various alkaline and acid media of the juices of the alimentary canal, (c) solubility, (d) rate and direction of diffusion, and (e) last but not the least, rate of elimination.

(B) **IONIC HYPOTHESIS**: The action of a drug also depends upon electrolytic dissociation of its solution and so the effect depends upon the potency of ions which are the result of such dissociation. When acids, bases or salts are in aqueous solution sometimes an abnormally high osmotic pressure is observed; this pressure is due to the swelling in the number of particles present in the given volume. This phenomenon is due to the dissociation of the molecules into ions, and is called **ionisation**. The ions are chemically different from their parent molecules. And from the fact that the proportion of molecules ionised is shown to become greater as more and more of the solvent is added, and that the removal of the solvent diminishes the proportion of ions to molecules and finally leaves us the substance entirely resorted to the molecular condition, we know that this is a reversible action and therefore a true dissociation. "The substances which undergo dissociation in solution divide themselves into a special kind of electrically charged molecules. These units, or rather ions, are forthwith distinct substances, save that the attractions of the charges prevent separation by diffusion". The effect of an electric current on the solution of an electrolyte is to make one set of particles (anions of the basic radicles) move in the direction of the negative current, and to make another set of particles (cations of the acid radicles) move in the direction of the positive current. "An ion may therefore be defined as an atom or a group of atoms bearing a positive or negative charge of electricity and formed through the dissociation of an ionogen

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by a solvent like water." The application of this theory to pharmacology lies in the fact that it is the ions of the salts and not the molecules which produce the action. If ions are not potent what is called "salt action" takes place.

(C) **Salt action in Pharmacology:** It has already been found that soluble inorganic salts in solution produce their action by being dissociated into ions and that this process depends upon a specific chemical action brought about by the dissociated ions. Ions greatly differ in their readiness with which they are absorbed by the mucous membranes. In the human body the epithelial cells of vessels, and the cells of the renal glomerule act as semi-permeable membrane, i.e., a membrane which admits the solvent but not the dissolved substance. If two equimolecular solutions are separated by such a semipermeable membrane the osmotic pressure is equal on the two sides and the solutions are then said to be 'isotonic', and no exchange of constituents occurs between the two fluids. In pharmacology the term 'isotonic' means a solution having the same osmotic tension as that of the blood. If however, a given volume of one of these fluids has a higher molecular concentration than that of the other, it is said to be 'hypertonic', and the other 'hypotonic'. An intercharge takes place when two fluids meet, water being attracted from the 'hypotonic' to the 'hypertonic' solution; substances in solution do pass from the 'hypertonic' to the 'hypotonic' solution, but to a very small extent only. When a series of reactions due to changing osmotic conditions take place a purely physical process is the result, no chemical action taking place. Such a phenomenon is called 'Salt action'. Osmotic effects of any importance can be produced by soluble salts given in sufficient quantities They can be given when neither of the two ions possesses any pronounced physiological action. To illustrate the salt action, Sodium Chloride may be taken as an example as the ions liberated in a salt solution exert little physiological action. Sodium Chloride will influence, according to its concentration, the passage of fluids into and out of the cells When a red blood corpuscle, for instance, is

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placed in a hypotonic solution it will swell from entrance of water into it. If the solution be isotonic the corpuscles will remain unaltered as the osmotic pressure inside and outside the membrane will be the same. If the solution be hypertonic water will pass out of the corpuscle into the surrounding fluid.

(D) **Action of drugs on living matter:** Pharmacological action depends upon the reaction of the living matter. Living matter is alkaline in reaction but becomes acid after death. The alkaline reaction of the body is due to the excess of 'OH' ions. Acid reaction is due to 'H' ions. The concentration or otherwise of these ions depends upon the metabolic processes resulting from the ingestion of food, drug or poison.

The simplest assumption regarding the nature of this reaction is that the drug combines with specific receptors in the cells. Modern Bio-Chemistry is revealing the cell as a complex system of enzymes whose activities are organised and correlated in an unknown manner. As a general rule, the action of drugs on patients can be interpreted on the assumption that the administration of the drug results in a certain concentration being attained in the blood-stream and tissue fluids, and that a chemical action occurs between the drug and the cells.

Individual variation in response to drugs :

It is important to realise that no two individuals respond to any drug in an identical manner. The existence of wide individual variation in response to drugs is a fact which is perfectly familiar to every experienced practitioner of medicine, but the extensive data that have been collected in connection with the biological standardisation of drugs have provided a considerable amount of information about the manner in which this variation is distributed.

Absorption of drugs:

The great majority of drugs are given by the mouth and as a general rule they are not absorbed from the fundus of the

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stomach. If a tablet is sucked, absorption may occur from the mucous membrane of the mouth and this is a simple method of obtaining a rapid action with such drugs as Nitro-Glycerine. When a drug is swallowed rapidly absorption does not commence until it passes through the pyloric sphincter ; hence the time of commencement of absorption depends upon the activity of the stomach and may vary from fraction of a minute to more than two hours.

The gastric functions are deranged by many diseases and in particular by fever, hence it is unsafe to estimate the probable rate of absorption in a sick person from the rate of absorption which occurs in health.

Clearance and detoxication of drugs :

Drugs are removed from the body in two ways, some are excreted unaltered, whilst others are first rendered inert and then excreted. The organs of excretion are the kidneys and the liver ; but the liver is a relatively inefficient route as some drugs that are excreted in the bile are reabsorbed from the intestines. On the other hand, the liver is the most important organ that defends the body against the absorption of toxic substances from the gut ; it takes, therefore, greater share in the inactivation of drugs. In certain cases these are neither excreted nor inactivated, but are fixed by tissues on which they produce a little effect. Fixation of this type is liable to produce cumulative effects. Detoxication of drugs is carried out in various ways by the liver, the most important methods being synthesis to form inert compounds, and destruction by enzyme action. The kidneys resemble the liver in their power, since they also can pick up, store, or excrete drugs, and also can perform certain syntheses of drugs. The defence mechanisms of the body are not confined to the liver and the kidneys but are numerous and varied. The power of the body to form and maintain, in its blood-stream, anti-toxins which combine with and render harmless poisonous proteins is the most remarkable of all its defence mechanisms. It is of interest to note that

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most drugs which undergo change in the body are detoxicated ; yet there are examples of drugs which are activated in the body.

Excretions of drugs :

The commonest method of the removal of a drug is excretion by the kidneys ; but the rate of excretion of different drugs varies enormously. For example, in fortyeight hours, 80 % of a dose of potassium Iodide is excreted, but only 5 % of a dose of Potassium Bromide is excreted. The drugs which are excreted slowly are naturally the ones which accumulate to the greatest extent in the body. The kidneys are the chief channels of excretion of drugs ; but the metals are to a large extent excreted in the colon and a few alkaloids such as morphine and emetine are excreted in this manner.

When a pharmacological action is required for a limited period only, as in the case of hypnotics, then drugs are chosen which are either excreted rapidly or else rapidly detoxicated by the body. In the majority of cases Clearance of a drug by enzyme action follows an exponential cause, that is to say, a constant fraction of the drug present is removed per unit of time. It would appear that, as a general rule, drug clearance, whether by excretion or detoxication, follows this course.

Rate of action of drugs:

The time that is likely to elapse between the administration of a drug and the development of its full action is frequently a question of great importance. As has been explained, when a drug is given by mouth a delay of an hour or more frequently occurs before the action appears. Similarly in some cases there is considerable delay in the absorption of subcutaneous or intramuscular injections. When a drug is given intravenously the full concentration in the bloodstream is produced immediately, and in some cases immediate response is obtained.

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CHAPTER II

DRUGS.

CRUDE DRUGS :—By this term is meant dry or raw vegetable drugs which are brought to the market and utilised for the preparation of different medicinal products. The value of these drugs depends on the presence of the 'active constituents' which are more or less definite chemical bodies in the plants. These are found in different parts of the plant and therefore that particular part is used as the crude drug. Sometimes, they are found in all parts of the plant. Some are, therefore, used 'whole' and some 'in part' only. The potency of the crude drugs depends entirely on how they are selected and preserved ; because it is found that many drugs often deteriorate if they are not properly preserved. Genuine and efficient drugs will be available only if they are first selected carefully and then preserved properly. They have, therefore, to be protected from the inclemency of weather and stored with necessary precautions. In the case of drugs containing the active principle in some parts only, it is desirable to ascertain that part first and then preserve it.

Sources and Habitat of Drugs.

In the present work we are concerned only with the sources of 'organic' drugs i. e. drugs from the vegetable kingdom.

By 'habitat' is meant the natural abode or locality of a plant from which a drug is obtained.

Identification.

The first and foremost difficulty of a medical man intending to experiment with the indigenous drugs will be their identification. This will remain the prime difficulty until a collection is made of all of them bearing the same name and their prominent diagnostic characters are ascertained, and also certain prominent characters of each drug are established. It is also

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necessary to know their scientific names and their popular equivalents in different regional languages. It is due to this difficulty that many of the remedies mentioned in the old books baffle recognition and identification. Neither the common druggists and herbalists nor the professional herb-mongers are of any appreciable help to us in this respect, as the specimens obtained from the former cannot be trusted as they are sometimes wrong and there is also often the danger of adulteration, and the latter scarcely know the extent to which the appearance and habit of a plant become altered by the influence of its habitat. Shrubs in the low country, small and stunted in growth, become handsome and tall on the higher grounds but to the inexperienced eye they appear to be different plants. Datura Alba, for instance, is three or four times bigger in size on the hills than it is on the plains. The same remark may be applied to flowers and flowering seasons, especially to the latter. No amount of verbal description of these drugs will, therefore, enable botanists to identify them and hence the necessity of the constant and continuous study of the habits of a plant in different localities before its identification is established. Uniform nomenclature goes a long way in the identification of plants. But this, however, has been found to be almost an impossibility by many a botanist on account of the vastness of the country. It is, therefore, found that the same drugs are sold under different names and different drugs under one name. It is, therefore, necessary that the Ayurvedic student should study Botany carefully as it will help him in sorting out drugs. Nighantus are of little use in this respect as the classification given in them is more or less in the form of a glossary. It must, however, be said to the credit of the Nighantus that they are fine collections of drugs with their pharmacological actions and therapeutical uses, briefly described, so that the knowledge could be handed down to posterity.

Now, it is true that the recognition of crude drugs is not a necessity to the doctors who deal in foreign drugs belonging to the British Pharmacopeia. But as the Ayurvedist has to

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collect, identify, and select his own drugs, and to subject them to preliminary processes before using them, it is necessary for him to study not only their botanical characters but also their chemical composition. Thus a chemical mind is absolutely necessary to the Ayurvedist as he is required to know the differences in रस (Taste.) गुण (Property), and वीर्य (Efficacy) of the same plant in different localities. The potency of the drug varies according to the soil, altitude, mode of culture, time of gathering, and the manure used. Exaggerated descriptions of the specific properties of some plants have been given in some Works, without sufficient evidence. This has done a great deal of harm to the reputation of indigenous plants. often-times the useless drugs have been stamped as important, along with the useful. Systematic research alone will remove this indiscrimination and establish the value of the useful ones. Thereby the confusion which now exists will be removed and the true teachings of the Ayurvedic school brought to light. Another reason why some botanical and chemical knowledge is necessary is the necessity of devising economy, so that the drugs may reach the poor class also. By such a knowledge, the production, collection, and manufacture of local remedies can be developed, and one would be in a position to substitute the indigenous drugs for the more expensive foreign ones. India, owing to the remarkable variations she possesses of climate, altitude, and soil, is in a position to produce successfully every variety of medical herbs, required not only by India but also by the foreign countries.

Cultivation and Collection of Drugs.

Much of the medical value of drugs depends upon the season in which they are grown and cultivated. Drug-cultivation, by itself, is not an independent industry in India as in western countries. The development of this industry is a necessity to the medical-profession. In almost all the authoritative works on Medicine, some references regarding the Botanical Geography, the site and climate agreeable to different plants, the soils and seasons for collecting and storing them

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are found. There is again evidence to show that even in Buddhistic period, pharmaceutical gardens were established for the use of medical profession. Elaborate directions are to be found regarding the manipulation of drugs. But this industry has fallen into background owing to the (1) the absence of the knowledge of plant-physiology in medical men and their apathy (2) want of encouragement and patronage from the State, and (3) importation of foreign drugs.

Preservation of Drugs.

Many drugs have to be dried before they are preserved. Preservation is quite necessary as the drugs growing in unreachable parts, such as the Himalayas, are not available to the physicians in other parts of the country; secondly, drugs growing in one season are not available in others. So, the process of drying has to be carried out properly in order to preserve not only the drug itself but its active principles also. To promote drying, drugs have to be sliced or cut into pieces, either longitudinally or transversely. Drying not only assists the process of powdering, but also preserves the drug which would otherwise ferment and get soiled. A pharmacist should therefore know what a ferment is, how fermentation is caused or prevented, and further if the ferment is not avoided what results would ensue to the detriment of the drug. The pharmacist also requires to know how the ferment might be made useful for industrial and other purposes. This means he should have some training in Bacteriology.

Then comes the question of temperature at which the different drugs have to be dried. All drugs require to be dried slowly. High temperature or overheating in order to hasten drying often injures the active principles in the drugs. Some drugs have to be dried in the sun, some in dry air only, some in a current of warm air, some in a drying-cupboard at a temperature varying between 50° C to 100° C, and some at ordinary temperature in a closed space; for, a higher or lower temperasure may prejudicially affect the quality of a drug by starting some chemical change. Superficial examination alone

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is quite insufficient as the only reliable and perfect method of identification is afforded by microscopical and chemical examination.

In spite of the absence of the method referred to above the ancient physicians had admittedly made considerable progress in the art of selection and preservation of drugs, as will be seen from the quotations given herebelow:

1. Rejectable Drugs:—

वल्मीक कुत्सिताऽनूप श्मशानोषर मार्गजाः ।
जंतुवन्हिहिमव्याप्ता नौषध्यःकार्यसाधिकाः ॥ (द्रव्य भाग भावप्रकाश)
— कलिंग परिभाषा नि. र.

Translation: Those plants which grow on ant-hills, filthy ground, watery (marshy) places, burial ground, barren and saline soils; and open streets, do not serve a medical purpose: similarly those drugs which are infested with insects and affected by fire or cold are useless.

2. Preservation of Drugs:—

(i) धूमवर्षानिलक्लेदैः सर्वर्तुष्वनभिद्रुते ।
ग्राहयित्वा गृहे न्यस्येद्विधिनौषधसंग्रहम् ॥ (द्र. भा.)

(ii) प्लोतमृद्भांड फलक शंकुविन्यस्त भैषजम् ।
प्रशस्तायां दिशि शुचौ भेषजागारमिष्यते ॥ (भा. प्र.)

Translation:

(i) Medicines should be systematically preserved in a room, where the atmosphere is not affected by smoke, rain, draughts or dampness (moisture), whatever may be the season of the year.

(ii) Medicines should be covered by pieces of linen and kept in earthen or China-clay pots or wooden boxes, or hung on pegs after being well protected; such a drug-apartment as is situated in a clean and suitable place is always desirable.

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3. **Gathering Times:—**

शरद्यखिलकार्यार्थं ग्राह्यं सरसमौषधम् । (द्र. भा.)
विरेकवमनार्थं तु वसंतांते समाहरेत् ॥ (भा. प्र.)

Translation: Winter is the best time for gathering juicy parts of the plants; then they become useful for all purposes Those which are intended for emetic or purgative purpose. should be collected at the end of Spring.

4. **Parts of Plants Used:—**

अतिस्थूलजटायाः स्युस्तासां ग्राह्यास्त्वचो बुधैः ॥
गृण्हीयात्सूक्ष्ममूलानि सकलान्यपि बुद्धिमान् ।
महांति येषांमूलानि काष्ठगर्भाणि सर्वतः ॥
तेषां तु वल्कलं ग्राह्यं ह्रस्वमूलानि सर्वशः ।
न्यग्रोधादेस्त्वचो ग्राह्याः सारः स्याद्बीजकादितः ॥
तालीसादेस्तु पत्राणि फलं स्यात्त्रिफलादितः ।
धातक्यादेश्च पुष्पाणि स्नुह्यादेः क्षीरमाहरेत् ॥
(द्र. भा. भा. प्र)

(a)

i. In the case of plants which have thick roots, the rootbark should be selected and in the case of plants which have thin roots, the whole root should be used. The bark is preferable in the case of such trees whose roots are very big and contain much of Xylem (the woody portion of vegetable tissue) in them; and in the case of those which have short and slender roots, the whole plant should be selected.

ii. The bark of such trees (Ficaceae) as वट (Ficus bengalensis), the gum-resin of such trees as बीजक (Pterocarpus Marsupium), the leaves of such plants as तालीस (Abies Webbiana), the fruits of such trees as the Three Myrobalans, the flowers of such trees as धातकी (Woodfordia Floribunda), and

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iii. the milky juice of such shrubs as स्नुहि (Euphorbia Antiquorum) are fit for selection.

(b) क्वचिन्निंबस्य गृण्हीयात्पत्राभावे त्वचामपि ।
बालंफलं तु बिल्वस्य पक्वमारग्वधस्य च ॥
अंगेऽनुक्ते जटा ग्राह्या भागेऽनुक्तेऽखिलं समम् ।
पात्रेऽनुक्ते मृदःपात्रं कालेऽनुक्तेत्वहर्मुखम् ॥
द्रव्येऽनुक्ते जलं ग्राह्यं तैलेऽनुक्ते तिलोद्भवम् ।
नवान्येव हि योज्यानि द्रव्याण्यखिल कर्मसु ॥
विना विडंगकृष्णाभ्यां गुडधान्याज्य माक्षिकैः ।
पुराणं तु प्रशस्तं स्यात्तांबूलं कांजिकं तथा ॥
शुष्कं नवीनद्रव्यं तु योज्यं सकल कर्मसु ।
आर्द्रं तु द्विगुणं योज्यादेष सर्वत्र निश्चयः ॥
गुडूची कुटजो वासा कूष्मांडश्च शतावरी ।
अश्वगंधा सहचरः शतपुष्पा प्रसारिणी ।
प्रयोक्तव्याः सदैवार्द्रा द्विगुणा नैवकारयेत् ॥
वासा निंब पटोल केतक बला कूष्मांडकेंदीवरी ।
वर्षाभू कुटजश्च कंदसहिताः सा पूतिगंधामृताः ॥
ऐंद्री नागबला कुरंटक पुरोक्षत्रामृता सर्वदा ।
सार्द्रा एव तु न क्वचिद्द्विगुणिताः कार्येषु योज्या बुधैः ॥
घृतं तैलं च पानीयं कषायं व्यंजनादिकम् ।
पक्त्वा शीतीकृतं चोष्णंतत्सर्वं स्याद्विषोपमम् ॥

Transltion: (b)

i. In the case of निंब (Melia Azadirachta), the inner bark should be selected if the leaves are not available; in the case of बिल्व (Aegle Marmelos), the young fruit should be preferred to the ripe one; and in the case of आरग्वध (Cassia Fistula), the ripe fruit is preferable to the raw one.

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ii. When, in prescription, the part of the plant is not mentioned, the root should be chosen, and when the proportion of the ingredients is not stated, equal parts of them should be taken. When a particular kind of utensil is not stated an earthen vessel should be chosen, and if the time of administration of medicine, is not mentioned the morning hour is preferable.

When the vehicle is not mentioned water should be taken, and when the kind of oil is not prescribed, sesamum oil should be taken.

iii. As far as possible only fresh drugs or plants should be used in medicine; the exceptions are विडंग (Embelia Ribes), पिप्पली (Piper Longum), joggery, coriander, ghee and honey.

iv, v, & vi. Old (but not dry) तांबूल (Piper Betel) leaves and old (but not fresh) Conjee are preferable. Dry but fresh plants should be used as far as possible in medicine, and if they are green (raw) double the usual quantity should be taken. The following plants should always be fresh (green) when gathered, but their proportion should not be double as mentioned in the foregoing sentence, though the plants are fresh.

1. गुडूची — Tinospora Cordifolia.
2. कुटज — Holarrbena Anti-dysenterica.
3. वासा — Adhatoda Wasaka.
4. कूष्मांड — Benincasa Cerifera.
5. शतावरी — Asparagus Racemosus.
6. अश्वगंधा — Withania Somnifera.
7. सहचर — Barleria Prionitis.
8. शतपुष्पा — Foeniculam Vulgare.
9. प्रसारिणी — Poederia Foetida.

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vii. Similarly, the following should be collected when they are yet green, but their proportion should not be doubled.

1. वासा — Adhatoda Wasak.
2. निंब — Azadirachta Indica.
3. पटोल — Trichosanthes Dioica.
4. केतकी — Pandanus Odoratissimus.
5. बला — Sida Cordifolia.
6. कूष्मांड — Benincasa Cerifera.
7. इंदीवर — Nymphaea Stellata.
8. वर्षाभू — Boerhaavia Diffusa.
9. कुटज — Holarrhena Anti-dysenterica.
10. पूतिगंध — Poederia Foetida.
11. ऐंद्री — Citrullus Colocynthis.
12. नागबला — Sida Acuta, Carpinifolia.
13. कुरंटक — Barleria Prionitis.
14. पुर (गुग्गुलु) — Balsamodendron Myrrh.
15. क्षात्र — Pimpinella Anisum.
16. अमृता (धात्री) — Phyllanthus Emblica.

viii. Ghee, oil, water, decoctions and spicy articles should not be heated again after they are once got ready for use, even if they become cold.

(e) एकमप्यौषधं योगे यस्मिन्यत्पुनरुच्यते (कालिंग प. भाषा)
मानतो द्विगुणं प्रोक्तं तद्द्रव्यं तत्त्वदर्शिभिः ॥ (नि. र.)

Translations: When an ingredient is repeated in a prescription, it should be understood that double the quantity of that ingredient should be taken.

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(d) गुणहीनं भवेद्वर्षादूर्ध्वं तद्रूपमौषधम् ।
मासद्वयात्तथा चूर्णं हीनवीर्यत्वमाप्नुयात् ॥
हीनत्वं गुटिकालेहौ लभेतं वत्सरात्परम् ।
हीनाः स्युर्घृततैलाद्याश्चतुर्मासाधिकास्तथा ॥
ओषध्यो लघुपाकाः स्युर्निर्वीर्या वत्सरात्परम् ।
पुराणाः स्युर्गुणैर्युक्ता आसवा धातवो रसाः ॥
(कालिंग परिभाषा नि. र.)

Translation:

i. Plants, if kept without proper precautions, lose their properties after a year, and Powders after two months.

ii. Pills and electuaries lose their properties after a year and oils and ghee after four months.

iii. Plants (like cereals) whose ripening period is short lose their properties after a year. But Asawas, Metallic preparations and रसायनs (Rasayanas) retain their properties even though they become old.

(e) व्याधेरनुक्तं यद्द्रव्यं गणोक्तमपि तत्त्यजेत् ।
अनुक्तमपि युक्तं यद्युज्यते तत्र तद्बुधैः ॥ (क. प. भा. नि. र.)

Translation: If a certain member of a गण (Gana) compound, prescribed for a certain malady, is not applicable to that malady, it should be rejected; but a drug which is virtually applicable, but not prescribed, should be used.

Regarding the time of collection minute instructions were given for the guidance of the vaidyas. Annual plants were to be collected before the ripening of the seeds, biannuals in the spring and perennials in the autumn; the root was to be collected in the cold season, twigs were to be collected of the present year's growth, the leaves were to be collected in the hot season, and the bark and the woods in the rains.

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All the different parts of plants are generally used in Ayurved according to requirements. The selection of a particular part depends upon the presence of medicinal value in that part. The particular part that is used has been recorded in the Nighantus ; this is because of the different properties that exist in the different parts of a plant. For instance, the leaves, roots and fruits of बिल्व (Aegle Marmelos) have properties different from one another. Similarly, the roots, leaves and seeds of गुंजा (Abrus Precatorius) possess different properties. The seeds of this latter plant are very poisonous and therefore they require to be boiled in milk and water and then prescribed. The albuminous poisons lose their activity when they are boiled. Having recognised these facts, the Ayurvedists have given elaborate methods of manufacturing drugs before they are used in preparations. Many drugs. especially the poisonous ones, necessarily require to be subjected to certain processes of purification. These processes have been described in the books on Medicine. Some of these processes have been given under वातव्याध्याधिकार (Watavyadhyadhikara.....) in भैषज्य रत्नावलि (Bhaishajya-Ratnavali); others in the Chapter on (Upavisha) उपविष in निघंटुरत्नाकर (Nighantu-Ratnakara).

The parts of plants used for medicinal purposes are:—

1. मूल Root e.g. पाठा (Cissampelos Pareira).
2. कंद Underground-Stem-e.g. विदारी (convolvulus or Ipomoea Panicnlatus)
3. पत्र Leaf ; e.g. तमाल (Cinnamomum Tamala).
4. पुष्प Flower ; e.g. धातकी पुष्प (Woodfordia Floribunda)
5. फल Fruit ; e.g. त्रिफला (Terminalia Chebula, T. Bellerica, Phylanthus Embelica).
6. सार Gum Resin खदिरसार (Acacia Catechu).
7. त्वक् Bark; e.g. दालचिनी (Cinnamomum Zeylanicum).
8. काष्ट Wood ; e.g. देवदारु (Pinus Deodara).

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9. स्वरस Fresh or inspissated juice. Fresh :—Wasaka (Justicia Adhatoda) Inspissated:— कुमारी (Aloe Indica), लाक्षा (BUTEA FRONDOSA) हिंगु (Ferula Foetida)

10. क्षीर Milky juice ; e.g. स्नुही (Euphorbia Antiquorum).

Sometimes the whole plant, as in the case of कंटकारी (Solanum Jacquini), is used. Here a note of warning has to be recorded. A crude drug may contain several unlike and even opposite principles and these again may occur in different specimens of the drug so that one sample of a crude drug may be stronger than another. Such samples similarly labelled may produce entirely different and even conflicting results. The tinctures prepared in some of the modern pharmacies show this defect sometimes. It is, therefore, safe to make a proper discrimination between plant and plant before it is used. In fact, such an object is rarely accomplished except with the help of chemical or botanical assay. There is no doubt that accuracy and safety are both ensured by these methods. In fact, standardisation of drugs and preparation is an important factor to secure therapeutical uniformity so that the amount of active principles in each dose is not subjected to irregular variations.

The instructions given by Col. Dr. R. N. Chopra on this subject deserve to be noted down here.

Important points to be remembered by the collectors of medicinal drugs are:—

1. Variations in the active principles in the different organs of the same plant.

2. Variations in different season in the same organ of the plant.

3. The same organ, e.g. young and old leaves, opened and unopened flowers, will show remarkable difference in the contents of its active principles at different times.

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General Rules for Collection:

1. Roots, rhizomes and bark should be collected in late autumn and early spring.
2. Leaves, when proto-synthetic processes are most active, should be collected; this is usually about the time of development of flowers and before the maturing of fruits and seeds.
3. Flowers prior to, or just about the time of, pollination.
4. Fruits near the ripening period i.e. when they are fullgrown but unripe.
5. Seeds: when fully matured.
6. When one plant does not yield sufficient material for analysis or inspection, samples from individual plants should be collected separately and each should be divided into two parts. Portions of each should then be mixed in one sample and the remaining should form another sample.

Need of Scientific Study of the Characters of Drugs.

The character of drugs may be either (a) physical i.e. botanical, giving the description of plants, or (b) chemical, signifying the chemical composition of the plants.

Regarding the botanical characters of drugs.

The path of such a study is beset with a number of difficulties, and much has already been said on this score in Ch. I under 'The Sources and Habitat of Drugs'. It has also been shown there why a study of the drugs from the botanical standpoint is quite essential, for the identification of plants. It has also been observed that even the Nighantus, which, are, more or less, the collections of the names of drugs given in a promiscuous manner, are not of appreciable help to the student in respect of the identification of plants. Equally disappointing are the other Ayurvedic works on this subject. But it must, however, be admitted that the knowledge of the ancient Hindu-

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physicians regarding medicinal herbs was very vast and their vegetable Materia Medica decidedly very extensive. Even this extensive list given in same of the Nighantus contains plants unimportant from the therapeutical point of view but does not include some important drugs like Atropa Belladona, Artemesia Maritima, Ephedra Vulgaris, Hyoscyamus Nigra, Juniper Communis, Podophyllum Emodi etc., which grow on the Himalayas. Again, the present stock of Indian drugs consists of:

1. Indigenous drugs,
2. Some Unani drugs brought into India by the early Mahomedan immigrants in the eighth and the ninth centuries of the Christian era,

and 3. Some drugs lately introduced by the western botanists.

But many of these will be found to have not been mentioned in the Nighantus, and even those that are mentioned do not do adequate justice to their real character. Such instances are कुष्ठ, पुष्करमूल, पाटला, मोक्षक, पर्पटक, अग्निमंथ etc. There is still a large number of stray plants used by the village-physicians. Many of these also are not to be found in the Nighantus. Though these are not accepted by the Western Scholars working in this field in India, still they deserve due consideration from the standpoint of research work. To state an instance, Ayurvedic Materia Medica falls short of hypnotics, analgesics, and anaesthetics. It is, therefore, the duty of the Indian-Ayurvedic practitioner who comes across a remedy which possesses any of these properties to bring it to the notice of the workers concerned. Such a record of useful collections will certainly help the future workers in this field. So much for the Nighantus. Nor do the other works on Ayurved take us any further; for the Ayurvedists have given insufficient and hence incomplete description of some drugs regarding their character and habitat. Thus neither the Nighantus nor the other books on Ayurved can claim to be regular works on Materia Media, for a real work on Materia Medica has to contain the description of the स्वरूप

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(appearance), गुण (property) and कर्म (Action) of drugs. It is therefore rightly observed by the author चरक (Charaka) as follows :

न नाम ज्ञानमात्रेण रूपमात्रेण वा पुनः । (चरक सू.अ. १)
औषधीनां परांप्राप्तिं काश्चिद्वेदितुमर्हति ॥ (article 119.)

Translation: One cannot gain thorough knowledge (therefore the benefit) of drugs by simply knowing their names and forms,

And hence there is the necessity of keeping these three aspects constantly in view while identifying and naming the different drugs.

As India is a vast country with differences in climate, language, soil and traditional fads, it is not either possible for the physicians to get different drugs growing in the considerably distant parts of the country, or to identify and have a uniform nomenclature for them. It is, therefore, found that their substitutes or allied species of drugs are used by the vaidyas as is seen in the case of the following drugs:—

1. दारुहरिद्रा — Berberis Aristata.
2. मूर्वा — Sansevieria Zeylanica.
3. नागबला — Sida Acuta.
4. ज्योतिष्मति — Celastrus Paniculata.
5. पारसिक यमानि — Hyoscyamus Nigra.
6. रास्ना — Vanda Roxbwrghii.
7. सप्तला — Acacia Concinna.
8. प्रसारिणि — Paederia Foetida.
9. चुक्र —
10. आम्लवेतस् — Rumex. Vesicarius.

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A lot of confusion is, therefore, sometimes caused by this undesirable habit of using substitutes. But the method of collection and preservation of drugs based on a systematic study of modern Botany and Chemistry will surely remove all these imperfections. In view of the difficult nature of the task owing to the vastness of the country and the differences in its climate etc. as detailed in the foregoing paragraph, it is suggested that the Vaidyas and Hakimas and also other workers in this field should carry on this work on a co-operative basis.

Before concluding this article we should again emphasize the necessity of studying the botanical characters of drugs for the purpose of identification. And for this we cannot do better than quote some of the important instructions given to botanists by Bentham. These will be found to be of great value to the Ayurvedic physician, particularly to the one who practises in the rural area, as he has to be both a botanist and a pharmacist, in as much as he is required to collect, select, purify, and then use the drugs in his preparations.

Bentham's Instructions to Botanists.

"The principal object of Flora of a country is to afford the means of determining (i e. ascertaining the name of) any plant growing in it..... .....with this view a Flora consists of descriptions of all the wild or native plants contained in the country in question, so drawn up and arranged that the student may identify any individual specimen which he may gather.

"These descriptions should be clear, concise, accurate, and characteristic, so that each one should be readily adopted to the plant it relates to, and to no other; they should be, as nearly as possible, arranged under natural divisions, so as to facilitate the comparision of each plant with those most nearly allied to it; and they should be accompanied by an artificial key or index, by means of which the student may be guided with the least delay to the individual description belonging to the plant under examination.

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"Descriptions should be expressed as much as possible in ordinary well-established language. But for the purpose of accuracy, it is necessary not only to give a more precise technical meaning to many words used more or less commonly and vaguely, but also to introduce purely technical names for such parts or forms of plants as are of little importance except to the botanist.

"At the same time, mathematical accuracy must not be expected. Names cannot be invented for all the infinite forms and appearances assumed by plants and their parts. The same term is not only differently applied by different botanists but the same writer sometimes gives somewhat different meanings to the same word. The botanist's endeavours should always be, on the one hand, to make as near an approach to precision as possible and on the other hand to avoid that prolixity of detail and overloading with technical terms which tends rather to confusion than clearness."

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CHAPTER III

Chemical Composition of Drugs and Food-Stuffs.

As food-stuffs act on the body in the same way as drugs they are treated along with drugs here.

The importance of chemical knowledge to the student of medicine has already been referred to in the preceding articles. Modern medicine is becoming more and more dependent upon Basic Sciences. To the student of Pharmacology the ultimate solution of most sciences, whether physiological, or biological, comes through the application of Chemistry. The रस (Taste) गुण (property), and वीर्य (Systemic effect) of the Ayurvedic Pharmacology do bear chemical significance as they produce homogeneous changes in the body, corresponding to their chemical property. Reversely, the essential constituents of the human body are the products of the elements of our food. So a living body has no power of forming new elements, or of converting one elementary substance into another. It, therefore, follows that the elements of which the articles of food are formed must constitute the elements of the body of an animal. In this respect चरक Charaka rightly observes

परिणामतस्त्वाहारस्य गुणाः शरीरगुणभावमापद्यंते। (शारीर Ch. VI)

Translation :—Consequently, the properties of food are transferred to the tissues of the body.

The human body can perhaps be best visualised as a complex chemical factory where no one unit is independent but must work in harmony with the others Processes of disintegration, synthesis and exchange (many of which are yet little understood) are easily going on and it is only in the diligent application of the basic sciences to the working out of these phenomena, that the hope of elucidation lies. Ayurved has not failed to recognise this. It has in this behalf set down

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broad principles in a terse language. Charaka, for instance, lays down the following principle when discussing the activity of the chemical agencies during assimilation.

आहारपरिणामकरास्त्विमे भावा भवन्ति; तद्यथा उष्मा
वायुः क्लेदः स्नेहः कालः समयोगश्चेति ॥१३॥ (शारीर Ch. VI)

Translation: The following are the things which digest food and so are instrumental to the formation of tissues, like blood and other tissues also : 1. Heat, 2. Nervous processes, 3. Humidity, 4. Lubricating substances (oleaginous), 5 Time. and 6. Proper application.

Ayurvedists mainly depend upon the Pancha-Bhautika and Tridosha theories in the conception of their inorganic and organic bodies but they could not enter into detail probably because of the absence of fine instruments in those times. Modern scientists on the other hand, have developed the knowledge of the Basic Sciences with the help of instruments and it is up to the Ayurvedic students to acquaint themselves with these later advances in order to understand the fundamental principles of Ayurvedic Pharmacology in their relation to those of Chemistry. As the action of drugs and their active principles can only be established by a careful chemical, pharmacological, and clinical study, the investigation of all these three aspecte should be carried on side by side. It requires accurate knowledge of chemistry to determine what particular constituent of a plant is responsible for its curative or toxic action.

In the description of individual plants, in Part III of the book, we have mentioned the chief chemical constituents of each drug in order to facilitate a comparative study of the chemical nature of eastern and allied western drugs. This will, no doubt, create a desire to pursue the study of this subject in detail.

Proximate Principles of Organic Drugs.

1. Proteins.
2. Lipoids—Fats, Oils, Cholesterins, Waxes.

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3. Carbohydrates — Cellulose, Dextrin Gums, Sugars, Pectins, Starches, Glycogen.
4. Alkaloids.
5. Glucosides...(including Saponins and Sapotoxins).
6. Volatile, Ethereal, and Essential Oils.
7. Stearoptenes...Camphor, Menthol, Thymol.
8. Resins...Oleo-resins, Gum-resins, Balsams.
9. Organic Acids.
10. Colouring matter or Pigments...Chlorophyll, Carotine, Xanthophyll.
11. Ash...Inorganic residue when drugs or plants are ignited to constant weight at red heat.

PROTEINS.

Their classification:— Proteins are nitrogenous substances in the animal and the vegetable bodies. Carbohydrates predominate in plants while proteins in animals (in their tissues). Proteins are of primary importance in our diet as they form the very basis of our life.

They are classified by the English and the American Bio-Chemists into three main groups.

CLASSIFICATION OF THE PROTEINS.

Simple proteins:

1. Protamins } Chiefly in animals
2. Histons } Chiefly in animals
3. Globulins.....Commonest in plants.
4. Albumins...Serum albumin Egg-albumin, Lact-albumin, LEGUMELIN (in peas etc.), Leucosin (in wheat etc).
5. Glutenins.....in wheat and rice only.
6. Prolamins.....in cereal grains only.
7. Sclero-proteins (Albuminoids)...in animal tissues.
8. Phospho-proteins(Caseinogen)...in milk.

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Compound Proteins:

1. Haemoglobins.....in blood.
2. Glyco-proteins..... in mucin etc.
3. Phospho-proteins.....in casein and vitellin etc.
4. Lecitho-proteins (Phospho-lipin)...Not recognised as yet by English Chemists.
5. Nucleo-proteins...Most important as it is contained in nucleus and chromatin.
6. Lipo-proteins.

Hydrolysed Protenis: There are formed (derived) from the simple proteids by the process of Hydrolysis.

1. Proteins, Meta-proteins and Conjugated proteins..... Products of digestion.
2. Proteoses...Hpdrolytic cleavage-products of proteins that are soluble in water and not coagulated on heating.
3. Peptones.....Hydrolytic products of proteins. These are greatly diffusible.
4. Poly-peptides...Compounds of amino-acids. These are coagulable by heat but are diffusible.

The Function and Fate of Proteids in the Body.

When hydrolysed, proteins split up into different compounds such as albumoses, peptones, amino-acids; these are further oxidised in the body and are ultimately excreted as urea, Co_2 and H_2O. "It has been supposed that the proteid taken in with food has a twofold destination in the body, part of it going to supply the tissue-waste and being built up in the living protoplasm of the tissues (tissue-proteid); while the other and probably greater moiety passes into the juices that bathe the protoplasmic elements of the cells and is rapidly broken up and oxidised there without, at any time, forming an integral part of the protoplasm. This is spoken of as the circulating proteid". (Starling's Physiology).

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In addition to this part of the function in metabolism, proteids exert a specific stimulating action which is of a dynamic nature (heat-generation). Amino-acids are also converted partly into carbohydrate and consequently into fat, and thereby will also be the sources of heat and energy.

Chemical Properties of Proteins.

1. They are colloids mainly and will not, therefore, diffuse through a membrane.

2. The composition of average proteins is:-

C.....50.6 to 54.5 %.
H.....6.5 ,, 7.3 %.
N.....15.0 to 17.6 %.
S.....0.3 to 2.2 %.
P.....0.4 to 0.85 %.
O.....21.4 to 23.5 %.

Proteins give precipitations and colour-reactions. The colour depends upon certain chemical groups within the protein molecule, while the precipitate is due to a new compound formed with the reagent.

The following reagents precipitate most of the proteids:—

i Alcohol.
ii Mineral acids.
iii Excess of the salts of the alkalies.
iv Solutions of salts of heavy metals.
v Iodine in Potassiom Iodide.
vi Tannic acid.
vii Alkaloids

Poisonous Proteins.

Just as there are valuable varieties of proteids that constitute our food, similarly there are a number of protein-substances which are poisonous to animal life. These are called

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'vegetable agglutinins' as they coagulate milk and blood. They resemble bacterial toxins and have been found in a number of plants. The most important of these proteins are:—

1. Ricin.....from castor beans (एरंड).
2. Abrin .....from the seeds of Abrus Precatorius (गुंजा).
3. Crotin....from Croton Tiglium (जयपाल).
4. Curcin.....Jatropha Curcas (मोंगली एरंड).

II LIPOIDS.

(a) **Fats and Oils:** Fats and fixed oils are salts of glycerine with fatty acids, such as Palmitic, stearic and Oleic acids or mixtures of these in varying proportions. Oleins are liquids; the Stearins are solids; and the Palmitins are of vaseline-consistency. Both animal and vegetable fats are used in medicine. The most important animal fats are:

1. Lard or Swine fat.
2. Suet or Mutton fat.
3. Butter fat.
4. Tallow or Beef fat.

In Ayurvedic preparations butter fat is freely used. Butter fat is a mixture of Palmitin, Stearin, and Olein, and in addition it contains, like cocount-oil a high percentage (6 to 8%) of volatile fatty acids. Its chief value as a food exists in the vitamins which are so essential to growth and which no other fat can adequately supply.

The chief vegetable fats used in medicine are:—

1. **Palm oil:** consisting chiefly of Palmitin and cocoa-butter.
2. **Linseed oil:** consisting of oleic, linolic linoleinic, and iso-linolenic acids.
3. **Cottonseed oil:** consisting chiefly of Olein, Palmitin, Linolein, and a trace of linoleinic acid.

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4. **Olive oil:** consisting of 72% of liquid glycerids made up of Olein, Linolein, and Palmitin and a trace of Arachin.

5. **Castor oil:** consisting of mainly tri-ricinolein and dioxy-stearin.

6. **Croton oil:** consisting of Glycerids of at least ten fatty acids.

7. **Oleum Sesami:** consisting of (a) Sesamin, (b) liquid fats consisting of Glycerids of oleic and linoleic acids, (c) Sesamol..a phenol, and (d) Solid fats.....Stearin and Palmitin.

8. **Oleum Amygdalae Dulcis:** Consisting of a fixed oil and proteins. It does not contain amygdalin.

9. **Oleum Arachis:** consisting of glycerids of hypogoeic, lignoceric, arachidic, and linoleic acids; and olein.

10. **Oleum Chawlmoograe:** consisting of chawlmoogric acid, palmitic acid, glycerol and a small quantity of phytosterol.

CHEMICAL PROPERTIES OF FATS:

1. They are insoluble in water. Some are almost insoluble in alcohol also, Castor and Croton oils being the exceptions.
2. They are soluble in Ether, Chloroform, Benzoin, and Carbon-di-sulphide.
3. Fats can be heated to 200°C to 300°C without decomposition.
4. Lipases (ferments) hydrolyze fats into fatty acids and glycerine; similar action takes place during the early part of digestion.

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5. When boiled with alkalies, fats are hydrolyzed and the combination of alkali with the fatty acid is known as 'soap'. The hydrolyzed product readily emulsifies fats which are, therefore, easily removable by water; this explains the use of soap in washing.

Note: The difference between the fixed oil and the volatile oil is given under " volatile oils ".

The Origin, Function, and Fate of Fats in Plants and Animals.

The fat in animals is formed chiefly from carbohydrates and fats but sometimes from the proteids of food also (Vide Physiology).

Regarding the origin of fats in plants little is known definitely. Some chemists are of opinion that it originates from carbohydrates. That certain seeds like the almond and castor beans are rich in carbohydrates and poor in fats in the green state and vice versa when they ripen, goes to show that there is an exchange between the two principles.

In the economy of both plants and animals fats are connected with nutrition. They provide a food-reserve which is used on occasions of food-deficiency. They act as heat-producing factors in animals, while in plants their function is mainly protective preventing thereby desiccation.

Fats are commonly oxidized in the body and are a great source of heat. They are absorbed after being saponified, and when taken in excess are resynthesised by enzymes and ferments. Fat-absorption is retarded in diseased conditions of the Pancreas.

Normally about 2.5 to 6% is excreted in faeces. Nothing is found in urine normally al o, but in pathological conditions, such as diabetes, Bright's disease, disease of the pancreas, phosphorous poisoning, obesity, fatty degeneration etc., fat has been noticed in urine in variable quantities.

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(b) WAXES.

While fats are esters of glycerine, waxes are esters of higher fatty acids and monoatomic alcohols. Waxes are of both vegetable and animal origin. The surfaces of all organisms, both plant and animal, are covered with a layer of wax. The function of it is to protect the plant or animal from overwetting or overdrying and against the changes in temperature. Bee-wax and wool-fat are instances of waxes. The shells of eggs and larvae of insects contain wax.

Waxes are soluble in ordinary fat-solvents like benzene, ether, chloroform etc. They give no smell of acrolein when heated, as they do not contain glycerine. They are saponifiable like fats but with more difficulty.

(c) CHOLESTERINS (Sterols).

These are compounds of fatty acids and alcohol, and form constituents of waxes. The relation of sterol to waxes is the same as that of glycerine to fats.

Cholesterol is a typical instance of animal-sterol. It is found in every blood-cell to some extent and is probably a protective agent. It is chiefly found in brain-tisues, wool-fat, and gallstones.

It is insoluble in water and alkalies, partly soluble in soap-solutions, more soluble in solutions of bile-salts, and readily soluble in hot alcohol, ether, chloroform, and oleic acids. It is tasteless and odourless, cannot be saponified and is remarkably stable towards oxidation. Being less rancid and having a more penetrative action, it forms a suitable base for ointments.

Phyto-sterol, Sito-sterol are instances of vegetable fats containing sterols.

III. CARBOHYDRATES.

These are compounds of Carbon, Hydrogen and oxygen with a formula $\left(\begin{matrix} C & H & O \\ 6 & 10 & 5 \end{matrix}\right)$ as that in starch. In most of these

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compounds H and O are in the same proportion as in water. The Carbo-hydrates are very important constituents of foods primarily and of medicines secondarily. They are classified into:

(a) **Mono-saccharides :** These comprise the glucose group consisting of simple sugars like glucose, fructose, galactose, pentose etc. On hydrolysis they break into small compounds, the ultimate products being H_2O and CO_2.

(b) **Di-saccharides :** These are cane-sugar, maltose, lactose etc. which constitute the cane-sugar group. On hydrolysis, they break up into simple sugars whose ultimate products are H_2O and CO_2.

(c) **Poly-saccharides :** This is the cellulose group which consists of starches, glycogen, gums, pectins, cellulose etc. These are not sugars, but they can be hydrolysed into sugars.

CHEMICAL PROPERTIES OF CARBOHYDRATES.

1. All sugars are generally more easily soluble in hot than in cold water. A few require the addition of alcohol. Cellulose and peptins are insoluble in water.

2. All sugars give Molisch's reaction which is tested as stated below:

Treat the carbohydrate in solution with a few drops of 15% alcoholic solution of alpha-napthol. Then add slowly sliding down the side of the tube enough H_2SO_4 to form a layer at the bottom of the tube. A reddish violet band appears at the line of contact. This reaction shows the presence of a carbohydrate even when in combination with a protein. The test is due to the formation of furfurol.

3. With Fehling's solution starches, gums, and cellulose give no reduction until they are hydrolysed. Cane-sugar does not reduce it until inverted, while all other common sugars reduce Fehling's solution directly.

4. Generally, simple sugars ferment with yeast ; pentoses are an exception. Some ferment directly whilst others require hydrolysis.

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USE OF SOME OF THE IMPORTANT CARBOHYDRATES.

Sugars: These are used as flavouring and sweetening agents in medicine and are commonly good and useful preservatives in stronger solutions.

Molasses: This is the brown viscid uncrystallizable syrup which drains from sugar during the process of manufacture and is used as a laxative in domestic medicine.

Lactose: This is milk-sugar and is used in the preparation of infant-foods.

Levuluse: This is fruit-sugar given to diabetics as the latter cannot utilise glucose. It is found in honey which contains both grape-sugar and fruit-sugar.

Glucose: (Grape-sugar) is a viscous syrup colourless and odourless but with a sweetish taste. It is a very valuable article of diet in all conditions of exhaustion. It can be given by mouth and rectum as well, and also by the nasal tube. In the treatment of shock following an operation or collapse in cholera or other wasting diseases, an injection of a 5% solution (isotonic with blood) into the loose tissue of the axilla is a valuable remedy. Lately it is being used intravenously also.

Cellulose: is a mixture of complex carbohydrates. It forms part of the so-called 'crude fibre'. It is not digestible but helps digestion by stimulating the bowels mechanically. This is one of the reasons why fruits and vegetables which contain a large percentage of vegetable fibre are recommended in chronic constipation. Hemi-celluloses are insoluble in water, alcohol, and ether and are found in stony seeds and shells of nuts.

Pectins: These are carbohydrate-bodies whose composition is but known slightly. They are associated with cellulose in the plant. It is due to pectins that fruit-juices form a gelationous mass. So pectin is a carbohydrate-getting agent just as protein is a nitrogen-getting agent. Pectin is abundantly found in apples, pears, goose-berries, currants, carrots, beet-roots etc.

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Gums: These are desiccated exudations of certain plants obtained by incising the bark. They are a type of transparent carbohydrates isomeric with starch. Acacia and Tragacanth are the most important gums. These are used mainly as excipients or vehicles as they lesson the irritation of medicines. Their use is objectionable in cases where they are liable to be hydrolysed by bacteria on account of the irritating nature of the substances which remain as by-products. When mixed with colloids gums modify the acid-taste of some fruits in which they are contained.

IV ALKALOIDS.

These are active principles in drugs containing C, H, and N, and also O in some cases. Those containing O are solid and crystalline and are termed 'amides', while those not containing O are liquid and volatile and are called 'amines'.

Characteristics of Alkaloids.

The following are the characteristics of alkaloids:—

1. True alkaloids have an alkaline reaction. Purine bases are neutral to litmus.

2. They have a bitter taste.

3. Most of them have marked physiological or toxic properties. In cases of poisoning they have no characteristic post-mortem changes.

4. They combine with acids forming salts just as ammonium does. They are deomposed by alkalies.

5. The free alkaloids, though insoluble in water, are readily soluble in alcohol, ether, and chloroform.

6. They are precipitated by specific alkaloidal reagents, such as Iodine in Potassium Iodide, Picric Acid, and Mercuric Iodide.

7. On oxidization with Nitric acid (HNO_3) or Potassium Chlorate ($KCLO_3$) many give colour-changes.

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Classification of Alkaloids :

Alkaloids may be classified as under:

1. Natural alkaloids found in plants and animals: e.g. Morphine, Caffeine, and Adrenalin.
2. Artificial alkaloids..prepared from natural alkaloids: e.g. Apomorphine.
3. Synthetic alkaloids..these exist in nature and are also synthetically prepared: e.g. Suprarenin, Theophyllin etc.
4. Ptomains or putrefactive alkaloids which are met with in toxic as well as in non-toxic states. The toxicity in their case is due to the fact of their being not oxidized in the body. They are the result of microbic decomposition in the body. Putrescin, Cadaverin, Muscarin, and Cholin are some of the important members of this group.

PHYSIOLOGICAL ACTION OF ALKALOIDS.

Amines i.e. the liquid alkaloids are very slightly toxic and like Ammonia, they are excreted by the kidneys, the ultimate products being urea and carbon-dioxide. Many intermediate products are found in the body but their fate is very little known. The higher amines like Histamine (active principle of Ergot) are very active and even poisonous, their toxicity being related to the anaphylactic shock caused by some of them. Many amines, especially the substituted ammonias, raise the blood-pressure. Nicotin and Epinephrin are instances of this type. Their action is due to the stimulation of the sympathetic nerve-endings to the heart and blood vessels. But others like Strychnin cause slowing of the heart by stimulating the vagus nerve-endings.

Purine bases containing the Caffeine group are excellent diuretics, and stimulants of the respiratory and circulatory system. They cause diuresis by mainly causing greater elimination of the free water in the substance of the kidney; they act directly on the secreting cells. The opium-alkaloids

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are partly oxidized and the part that is unchanged is excreted by the alimentary tract. The oxidized portion passes out through the kidneys.

A few important Ayurvedic drugs containing alkaloids may be mentioned here:

Ayurvedic Name.	Latin Name.	Alkaloid.
1. उन्मत्त, धुस्तूर	Datura Fastuosa.	Daturine.
2. ताम्रकूट	Nicotiana Tabacum.	Nicotine.
3. अहिफेन	Papaver Somniferum	(Thebaine, Morphine, Codeine, narcotine, Papaverine, and Laudanine.
4. कारस्कर	Strychnos Nux-vomica.	(Strychnine, and Brucine.
5. खुरासनी यमानी	Hyoscyamus Reticulatus.	Hyoscyamine, Choline, Hyoscine, Scopolamine.
6. दारुहरिद्रा	Berberis Aristata.	Berberine.
7. वत्सनाभ	Aconitum Ferox.	Aconitine.
8. एरंड	Ricinus Communis.	Ricinine.
9. करवीर	Nerium Odorum.	Oleandrin.
10. विजया	Cannabis Indica.	Cannabin.
11. करंज	Pongamia Glabra.	Pongamine.
12. वासक	Adhatoda Wasaka.	Vasicine.
13. अतिविष	Aconitum Heterophyllum.	Atisin.
14. शेफालिका	Nyctanthes Arbor-tristis.	Nyctanthin.
15. बाकुची	Psoralea Corylifolia.	Vernonin.
16. सप्तपर्ण	Alstonia Scholaris.	Ditain.
17. पिप्पली	Piper Longum.	Piperine.
18. मरिच	Piper Nigrum.	
19. कंकोल	Piper Cubeba.	
20. निंब	Azadirachta Indica.	Margosin.

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Pharmacological Actions of some of the most important groups of Alkaloids.

I. **Isoquinolin Alkaloids:** These contain Opium, Ipecac, and Berberin groups. The actions of the Opium group are given below —

Actions of the Opium group.

The members of this group cause (a) marked depression of the central Nervous system, (b) lowering of the sensibility to pain, (c) depression of the Respiratory centre, and (d) lowering of blood-pressure etc.

II. **Solanum Alkaloids:** These contain (i) Atropine, (ii) Hyoscine, and (iii) Scopolamine groups.

General Characteristics : 1. These are readily absorbed in the system and excreted both by the kidneys and the intestines. 2. They are found in all the tissues, after administration. 3. Their main action is on the central Nervous system and it is ultimately of a depressing nature.

Actions of Individual Groups :

A. Atropine Group : Atropine, in moderate doses, stimulates the lower motor centres of the brain but causes paralysis of the peripheral parasympathetic nerve-endings

B. Hyoscine Group : Hyoscine does not stimulate the central Nervous system but acts as a depressant in small doses and causes convulsant effects if given in larger doses.

C. Scopolamine Group : Chemically and physiologically, scopolamine behaves in the same way as Hyoscine. It is used as an anodyne in therapeutics.

III. **Quinolin Alkaloids :** These consist chiefly, of the Cinchona Alkaloids and their derivatives. Cinchona bark and certain of the alkaloids contained therein have an extended and important use in medicine. The drug itself, depending on the variety, may contain a number of different bases, but the actual

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number with which the medical man is concerned is small. It is limited to four members only. They are 1. Quinine, 2. Quinidin, 3. Cinchonin, and 4. Cinchonidin. Of these the fixed two are treated here.

Quinine :

1. **Source:** Quinine is found in the bark of the various species of Cinchona which are the natives of South America (Peru). These are now cultivated in the East also. The alkaloid quinine was isolated in 1820, and a large number of other alkaloids which are present in smaller quantities in the cinchona bark were discovered a few years thereafter. The most important alkaloids of this bark are Quinine, Quinidin, Cinchonin, and Cinchonidin.

2. **Composition:** Quinine has the composition $C_{20}H_{24}N_2O_2$ and is composed of two rings, a quinoline ring and a piperidine ring.

3. **Pharmacological action:** Quinine differs from other alkaloids in having no high degree of selective action. It inhibits the action of many ferments, and in sufficient concentration kills all living cells. It is for this reason that it is stated to be a general protoplasmic poison. These are, however, some exceptions to this generalisation, for high concentrations of quinine are required to kill spermatozoa, and quinine salts, in the solutions of which moulds (penicillium) grow freely, have only a poor action on bacteria. Quinine has, however, lethal action on protozoa like the malarial parasite. One of the distinguishing features of the action of quinine is the relatively low concentrations of it that diminish the activity and vitality of protozoal organisms. It is owing to this property that it acts so successfully in malaria.

The malarial parasite is introduced into the blood of man by the bite of an infected mosquito (Anopheles). A sexual forms termed 'Schizonts' and sexual forms termed 'Gametocytes' can be produced in the human body, but the sexual forms cannot reproduce in man, but can do so in a mosquito. The

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schizonts enter the red-blood corpuscle of man and therein undergo a series of changes, forming numerous spores which eventually burst the corpuscle and escape into the plasma. The spores later enter a new corpuscle and repeat the process. According to the type of the malarial parasite, this cycle occupies either two or three days and as the fever coincides with the liberation of spores, there is a steep rise of temperature every two or three days, in tertian and quartan malaria respectively. These sexual cycles are repeated continuously as long as the conditions are favourable for the parasite, and as long as they continue, the patient suffers from acute malaria.

The sexual forms or gametocytes are produced when the conditions of life become unfavourable to the parasites. When the parasites produced are chiefly gametocytes, the disease assumes a chronic form. The action that quinine produces on an infection depends upon the length of time the infection has been established. A recent infection therefore is easy to cure with quinine, but an old-established infection is far more difficult to cure.

A malaria carrier is an individual whose body has acquired sufficient resistance to prevent the rapid asexual multiplication of the parasites, but not sufficient to destroy the organisms completely. The number of parasites is not sufficient to produce symptoms of acute disease and the majority are gametocytes. The majority of the native inhabitants in districts where malaria is endemic are carriers of this type. Such cases are highly infective to mosquitoes and hence encourage the spread of malaria.

Some types of malaria are more favourably influenced by quinine than others. In Benign Tertian Malaria the administration of quinine produces a very rapid improvement, although complete cure is very difficult. In malignant tertian fever where the parasite produces resting forms and gametocytes in large numbers, a large amount of quinine is required to produce improvement. Here the parasite passes about one quarter of its life in the blood-stream and the rest in the capillaries. So

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this form of infection is more resistent to drug treatment. The parasites appear to continue multiplying in the tissues for about ten days after they have disappeared from the blood.

Quinine is much less effective as an antipyretic in fevers other than malaria.

In small doses it is given as a stomachic bitter, but in large doses it is liable to produce digestive disturbances.

Of the other pharmacological actions of quinine, those on muscle must be mentioned here. Strong concentrations of quinine cause rigor of voluntary muscle. Low concentrations such as those given in medicinal doses, may cause increased contraction of the involuntary muscle, especially of the spleen or the uterus. It is indeed used to promote uterine contractions in labour, but it is not comparable in power to pitutiary extract or ergot.

Large or continued maximal therapeutic doses produce disturbances of hearing and sight viz. ringing in the ears, deafness, vertigo, and contraction of the field of vision. Usually these effects are transient and disappear when quinine is discontinued. Fatal doses of poisoning are rare when quinine is given by the mouth. It must be given with care intravenously, well diluted and at a very slow rate ; otherwise it may cause respiratory and cardiac failure.

Some persons show a marked idiosyncrasy to quinine and suffer from disturbances of hearing and sight even when small doses are given. In others, skin rashes are produced of which urticaria is the most troublesome. In such cases atebrin plasmoquin or paludrin, is more suitable.

Quinine also produces a marked action on the higher nervous centres of which mental dullness and confusion with a feeling of depression and a slight head-ache are the chief signs.

Most of the above symptoms are disregarded in the treatment of malaria, and quinine is given in doses upto 30 grains per diem, but doses larger than this cause injury to the kidneys and produce albuminuria.

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4. Fate of Quinine in the Body.

Tablets of quinine-sulphate are apt to pass through the alimentary canal without being absorbed. This failure of absorption is due to the coating which often contains french chalk. If the sulphate is given in suspension, or the soluble salt such as quinine hydrochloride is given, the drug is rapidly and completely absorbed. Absorption is not so complete when more than thirty grains are given in a day.

Quinine is excreted almost entirely by the kidneys. When given by mouth, a certain quantity appears in faeces, but this is due to deficient absorption, for, when the drug is given intravenously, only traces appear in the faeces.

The drug, when administered by mouth upon an empty stomach, appears in the urine within fifteen minutes. It is stated that about forty percent of the quinine taken is excreted in the urine, and about two-thirds is excreted in the first twelve hours, and most of the remaining in the next twentyfour hours. The sixty percent, which is not excreted, is broken up in the body and probably destroyed by the liver and the kidneys.

Owing to this rapid excretion and destruction of quinine if is necessary to give relatively larger doses frequently in order to maintain an efficient concentration in the blood.

QUINIDINE : Quinidine, a dextro-rotatory isomer of quinine, has much the same action and activity in malaria as quinine itself. It is used, however, chiefly in the treatment of auricular fibrillation. It was noticed that, in patients who suffered both from malaria and auricular fibrillation, quinine sometimes stopped the fibrillation of the auricle. Quinidine was found more effective for this purpose The use of quinidine is an interesting advance in cardiac therapeutics, for it actually cures the condition which is deranging the heart's action in auricular fibrillation, whereas digitalis is palliative, as it diminishes the injurious effects produced by fibrillation but does not cure fibrillation. It is only suitable for use in cases of

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auricular fibrillation of recent origin. It is advisable not to give it in cases of long standing. Because the sudden restoration of normal auricular beats by quinidine may dislodge a clot from the auricle and, when the possibility of this occurrence is suspected digitalis is safer.

Usually a preliminary dose of three grains is given to see whether the patient is not unduly sensitive to it, but the usual effective dosage is 3 to 6 grains three times a day for one to three days.

V GLUCOSIDES

Glucosides are crystalline substances which on hydrolysis yield glucose and another substance which is usually an aromatic body. Some glucosides contain C,H, and O; a few have N in addition; and one or two contain sulphur as well. Chemically they are ether-like combinations of glucose with alkaloids, acids, phenols etc. They are therefore different from gums, starches and sugars, They are decomposed by free acids into a sugar and an organic residue. Certain enzymes act also on glucosides; and generally the specific enzyme is present in the plant with the glucoside. Some glucosides are decomposed by alkalies also.

The pharmacological action does not depend upon the chemical composition of the glucosides as it is greatly variable. Some of the glucosides are highly poisonous, others are inert.

The important glucosides used in medicine are :—

1.	अतसी	..... Linum Usitatissimum.	Amygdalin.
2.	वाताम	..... Amygdalae Dulcis.	
3.	पद्मकाष्ट	..... Prunus Pudam.	
4.	कुमारी	..... Aloe Vera.	Aloin.
5.		..... Apples, Plums and Cherries	Phloridzine
6.	ज्योतिष्मति	..... Celastrus Paniculata.	Saponin.
7.	वरुण	..... Crataeva Religiosa.	
8.	मदनफल	..... Randia Dumetorum.	

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9.	विषमुष्टि	Aconitum Ferox.	Loganin.
10.	कटुकी	Picrorhiza Kurroa.	Picrorrhizin.
11.	इंद्रवारुणि	Citrullus Colocynthus	Colocynthin.
12.	मधुयष्टि	Glycyrrhiza Glabra.	Glycyrrhizin.
13.	मरिच	Piper Nigrum.	Sinigin.
14.	सर्षप	Brassica-Alba and Nigra.	
15.	श्वेतमरिच	Piper Album	Sinalbin.
16.	केशर, कुंकुम	Crocus Sativus	Crocin.
17.	करवीर	Nerium Odorum	Rosaginin & Neriene.
18.	नीलिनी	Indigofera Tinctoria	Indican.

Saponins: are a variety of glucosides which form froth when shaken with water, and which are used to emulsify oils and resins. Some are very poisonous and are termed sapotoxins. When injected directly into circulation, they cause laking of blood. Common instances containing these are :

1. ज्योतिष्मति .... Celastrus Paniculata.
2. वरुण .... Crataeva Religiosa.
3. अरिष्ट .... Sapindus Trifoliatus.
4. मदन .... Randia Dumetorum.
5. सप्तला .... Acacia Concinna.

VI OILS.

Oils may be fixed, volatile or essential.

Fixed Oils: These are described under 'Lipoids'.

Volatile Oils: These are obtained from flowers, roots and leaves of some plants. They differ from fixed oils chemically, physiologically, and pharmacologically. All of them contain C and H and most of them also O, N and S are found in some of them. Turpentine is the most common constituent of volatile oils. These are divided, for the sake of convenience, into three groups :

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1. Terpene group ($C_{10}H_{16}$) consisting of terpin derivatives, mixed with alcohols, aldehydes and acids. Hydrocarbons are readily prepared from these.
2. Menthol group ($C_{10}H_{20}O$) — These are crystalline substances which are not easily converted into hydrocarbons.
3. Camphor group ($C_{10}H_{16}O$)—The members of this group yield 'Camphene' which is the only solid terpene known.

Differences between Fixed and Volatile oils.

Fixed Oils.	Volatile Oils
1. Are rancid and leave a greasy spot.	1. Are volatile, inflammable, and lighter than water.
2. Form soaps with alkalies.	2. Do not form soaps.
3. Are insoluble in water.	3. Are partly soluble in water so as to impart to it some of the physical properties.
4. Do not explode with oxidising agents,	4. May possible explode.
5. Are completely oxidized in the body and excreted as CO_2 & H_2O.	5. Are excreted by the kidneys as conjugated glycuronates.

Pharmacology of Volatile Oils

When applied to the skin, they cause itching and redness and in some cases, a sensation of cooling and anaesthesia. Some oils like the mustard oil and the oil of garlic cause blistering of the skin when evaporation is prevented by covering them with a bandage.

Internally given, they act as sialagogues, stomachies, and carminatives. Their excessive doses cause irritation of the tissues and thus produce vomiting and diarrhoea. Very large doses cause disturbance of the central nervous system, and convulsions are seen to follow in some cases.

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The following is a list of some of the important Ayurvedic drugs containing volatile oils.

Name of the plant in Sanskrit.		Name of the plant in Latin.
1. लवंग	—	Eugenia Caryophyllata.
2. धान्यक	—	Coriander Sativum
3. निंबुक	—	Citrus Acida
4. शतपुष्पा, मिश्रेया	—	Pseudanum Graveolens.
5. कारवी	—	Pimpinella Anisum.
6. यमानी	—	Ptychotis Ajowan.
7. अजमोदा	—	Apium Graveolens.
8. जीरक	—	Cuminum Cyminum.
9. हिंगु	—	Ferula Foetida.
10. सुषवी	—	Carum Carui.
11. मधुरिका	—	Foeniculum Vulgaris.
12. प्रसारिणी	—	Paederia Foetida.
13. जटामांसी	—	Valeriana Jatamansi.
14. शिलारस	—	Liquidamber Orientalis.
15. तगर	—	Valeriana Wallichii.
16. देवधूप	—	Styrax Benzoin.
17. शेफालिका	—	Nyctanthes Arbortristis.
18. बृहन्मरिच	—	Capsicum Nepalensis.
19. निर्गुंडी	—	Vitex Negundo.
20. तुलसी	—	Ocimum Sanctum.
21. हपुषा	—	Juniperus communis.
22. कुलिंजन	—	Alpinia Galanga.
23. वनहारिद्रा	—	Curcuma Aromaticus.
24. हरिद्रा	—	Curcuma Longa.

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25. शठी —— Curcuma Zedoaria.
26. भूस्तृण —— Andropogon Citratis.
27. उशीर —— Andropogon Muricatus.
28. देवदारु —— Pinus Deodara.
29. सिद्धार्थ, सर्षप —— Brassica Alba and Nigra.
30. ककुंदर —— Blumea Balsamifera.
31. मुंडी —— Sphoeranthus Indicus.
32. कंकोल —— Piper Cubebs.
33. तांबूल —— Piper Betel.
34. चव्य —— Piper Chaba.
35. अगरु —— Acquilaria Agallocha.
36. कर्पूर —— Cinnamomum Zeylanicum.
37. त्वक् —— Cinnamomum Camphora.
38. जातिफल —— Myristica Fragrans.
39. मरिच —— Piper Nigrum.
40. पिप्पली —— Piper Longum.
41. शतपत्री (गुलाब) —— Rosa Damascena.
42. विडंग —— Embelia Ribes.
43. कंपिल्लक —— Mallotus Philippinensis.
44. एला —— Eletteria Cardamomum.
45. केशर —— Crocus Sativum.
46. शुंठी —— Zingiber Officinale.
47. पलांडु —— Allium Cepa.
48. लशुन —— Allium Sativum.
49. कुमारी —— Aloe Vera.
50. वचा —— Acorus Calamus.

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51. केतकी —— Pandanus Odoratissimum.

52. लामज्जक —— Andropogon Laniger.

53. श्रीगंध, (चंदन) —— Santalus Album.

VII STEREOPTENES-Solid Volatile Oils.

These are deposited at the bottom when a column of volatile oil is allowed to stand for fome time. They are oxidized forms of oil. Camphor, menthol and thymol are some of the important stereoptenes. Pharmacologically they are antiseptics, analgesics and stimulants. The first two are excreted through the kidneys in combination with glycuronic acid, and thymol is excreted combined whth glycuronic and sulphuric acids. The source of Indian thymol is a stereoptene known as 'Ajwanka phul (अजवानका फूल) which is identical in composition with the foreign one obtained from Thymus Vulgaris. Menthol is identical with Pudinaka-Phul (पुदीनाका फूल)-Stereoptene obtained from Mentha Sylvestris. It has not been mentioned by the Ayurvedic writers.

VIII. Resins, Oleo resins, gum-resins and Balsams.

These are obtained from the exudations of plants. They are compound chemical bodies insoluble in water, but soluble in alcohol and volatile oils.

Resins: These are solid, amorphus, bitter, non-volatile complex substances resulting from oxidation of hydro-carbons. They are insoluble in water but soluble in alcohol and alkalies.

Oleo-resins: These are solutions of resins in volatile oils.

Gum-resins: These are mixtures of resins with gums. They may exist with or without volatile oils.

Balsams: These are resins or oleo-resins that contain Benzoic or Cinnamic acids.

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Gums: These are exudations from stems or branches of plants. They contain 'Arabin' or 'Bassorin' or both; prunin, an insoluble gum, is sometimes found in some plants such as Prunus Pudam (पद्मकाष्ट) and Prunus Serotina (N. America). Chemically they are complex carbohydrates.

A few of the fmportant plants containing gums and gum-resins are given below:

1. अर्क — Calotropis Gigantea.
2. कचोरा — Curcuma Zedoaria.
3. कुष्ट — Saussurea Lappa.
4. करंज — Pongamia Glabra.
5. गुग्गुलु — Balsama-Dendron Mukul.
6. कुमारी — Aloe Vera.
7. ज्येष्टमिधु — Glycyrrizae Glabra.
8. नागकेसर — Mesua Ferrea.
9. (दालचिनी) त्वक् — Cinnamomum Zeylanicum.
10 गिंडाव्ह — Gardenia Gummifera.
11 कपित्थ — Feronia Elephantum.
12 सरल — Pinus Longifolia.
13 अश्वत्थ — Ficus Religiosa.
14 वट — Ficus Bengalensis.
15 उदुंबर — Ficus Glomerata.
16 प्लक्ष — Ficus Infectoria.
16 वचा — Acorus Calamus.
18 पलाश — Butea-Frondosa.
19 सुहीं — Euphorbia Antiquorum.
20 राल — Shorea Robusta.

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IX. **Organic Acids:** Almost all organic acids are found in plants either in combination with inorganic bases, or in a free state. They are either the second products of oxidation or the third products of the oxidation of Hydrocarbons Those more important in medicine are the salts of Acetic acid, Carbonic acid, Tartaric acid, Citric acid, and Hydrocyanic acid. They are broken up into CO_2 and H_2O and are excreted by the kidneys and the lungs. Hydrocyanic acid occurs in plants in the form of glucosides. It is present principally in the seeds and the bark.

X. **Tannin, Tannic acid, and Digallic acids:** These are found in the bark of all the plants and in some well-known fruits, such as Myrobalans and the Gallnuts. They form the chief constituents of all the vegetable astringents.

Ordinary tannin is roughly impure tannic acid, and on hydrolysis, yields 7 to 8% of glucose. When tannic acid is boiled with sulphuric acid it is completely converted into two molecules of gallic acid, which shows that the former is a gallic-acid anhydride. All tannins and salts of gallic acid are reducing agents and absorb oxygen readily. Pyrogallol is formed when gallic acid is heated, CO_2 being lost during the process.

The pharmacological action of tannic acid is due to its union with proteins in the body. It coagulates albumin and also forms insoluble compounds with metals, alkaloids and glucosides. It is therefore used as an antidote in cases of poisoning by alkaloids. The astringent action on the intestines is due probably to a protective material formed on the mucous membrane of the gut by the union of tannic acid with the mucous layer. The haemostatic action is due to the formation of coagulin in the lumen which mechanically obstructs circulation.

The following is a list of a few important plants containing tannin:

1. The त्रिफला .... Triphala-group of plants.
2. The पंजवल्कल .... Panchawalkala-group of plants.

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1. अर्जुन....Terminalia Arjun 2. कट्फल....Myrica sapida
3. बकुल....Mimusops Elengi 4. पूगीफल....Fruit of Areca Catechu
5. खदिर....Acacia Catechu 6. कांचनार....Bauhinia Variegata
7. बब्बुल....Acacia Arabica 8. आम्र ....Mangifera Indica
9. जंबू....Eugenia Jambolana 10. नागकेसर...Mesua Ferrea
11. अशोक....Saraca Indica 12. बदर ....Zizyphus Vulgaris
13. दाडिम....Punica Granatum 14. बिल्व ....Aegle Marmelos
15. असन ....Terminalia Tomentosa. 16. मायफल...Quercus Infectoria.
17. धातकी....Woodfordia Floribunda etc.

XI. COLOURING MATTER OR PIGMENT :

Plants contain many pigments but the chief of them are :

1. Chlorophyll—(green). 2. Carotin—(red).
3. Xanthophyll—(yellow).

Plant-colours have no physiological action, and if used at all in medicine, their effect is more or less psychic.

The following are some of the well-known colouring principles residing in some of the Ayurvedic drugs.

1. Curcumin-in the root of Curcuma Longa [हरिद्रा]
2. Red Sanders [रक्तचंदन] the heart-wood of Pterocarpus Santalinus.
3. Crocin-a glucoside which is the colouring principle of Crocus Sativus [केशर],
4. Indican-a glucoside of Indigoferra Tinctoria [नीलिनी].
5. Manjistin-in Rubia Cordifolia [मंजिष्ट].
6. Colouring matter of Lausonia Alba [मेंदिका]

XII. Ash : The ash of plants contains varying proportions of K, Ca, Mg, P, S, Fe, Si, Cl, Na, and also occasionally

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As, Ba, Mu, I, Zn. The quantities of C, H, N, and O are burnt away leaving no residue. The ash colour is due to the presence of Ca and Fe. Ash is generally alkaline owing to the presence of carbonates of Sodium or Potassium.

XIII. NEUTRAL PRINCIPLES : These are physiologically active substances with no distinguishing chemical properties. They have a neutral reaction and though they resemble glucosides closely, they do not yield sugar on hydrolysis. They are stronger and more toxic than bitters. Examples of neutral principles are :

1. Santonine prepared from the dried unexpanded flowerheads of Artemisia Maritima (किरमाणीओवा), a plant which grows in Afganistan, Persia, Tibet and the Western Himalayas.
2. Picrotoxin obtained from the seeds of Anamirta Cocculus (काकफल). It is a bitter poison, but in very small doses-1/60 th of a grain, is a nerve-tonic used in Epilepsy, Chronic Paralysis, chorea and night-sweats of Phthisis.

XIV. BITTER PRINCIPLES (तिक्तद्रव्य):

All distinctly bitter extractives other than alkaloids, glucosides and neutral principles which are not toxic are classified under the name of ' Bitters '. The character common to all the bitters is their taste only, there being no other distinguishing mark. They are used to improve appetite and also to stimulate gastric secretions. This they do reflexly through the sense of taste, and most effectively if they are given shortly before meals. Roughly, however, they are distinguished from alkaloids, from being precipitated by alkaloidal reagents. They differ from glucosides in not yielding sugar when hydrolysed. Being rather inert they are less active and so less poisonous than the neutral principles and alkaloids. When they are found in combination with tannin they are called ' Astringent-Bitters ', when with volatile oils, ' Aromatic Bitters ', and when they are free from both they are called ' Simple Bitters '.

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CHAPTER IV

Preparations, their Forms and Definitions.

The Ayurvedic Vegetable Materia Medica includes not only crude drugs proper but also a large number of preparations made from them: चूर्ण (powder) and कल्क (pounded mass) contain whole drugs; next to them come स्वरस (expressed juice) and पुटपाक (roasted-mass) and then follow गुटिका (pills) and मोदक (Bolus). स्वरस contain only those principles which are dissolved in the sap. Putapaka is another form where the preparation contains some more principles of the drugs owing to the action of fire. कषाय, क्वाथ, आसवारिष्ट, अवलेह, घृत, तैल are regular preparations of crude drugs containing varying quantities of the proximate principles according to the process through which the drugs are made to pass.

As different parts of a plant contain different properties, only those parts which contain efficient properties are used in the above-mentioned forms of preparation. Whole plants are used in the case of herbe which are very small and possess one uniform Rase [रस] in all their parts. Each variety of preparation has its own value in therapeutics. The Churnas are rather bulky preparations, and on account of their complex nature take more time to act. It is, therefore, desirable that only those drugs whose principles are easily soluble or separable should be chosen in the preparation of Churnas. Sugar, common salt, rock salt etc. are generally mixed with these powders in order to make them more active and palatable. Water, milk, honey and ghee are some of the common vehicles. In some cases, the juices of fruits like the lemon or pomegranate are used, as the organic acids, which they contain, facilitate the action of the Churnas. Before using the powders of the whole drugs it is therefore necessary to ascertain which drugs are water-soluble and which are not. In modern Pharma-

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copoea, alcohol, ether and the like are used as solvents to help the easy solution of the constituents which are insoluble in water. (Tinctures are instances of such processes). This is because modern pharmacologists are in favour of availing themselves of the important constituents only and not all the parts of the drugs. Ayurvedists, on the other hand, have attached more importance to the clinical findings and have based the pharmacological value of the whole drugs on the results of experience. In the place of tinctures they have used decoctions and infusions. They have again used extracts occasionally, evidently for the purposes of portability and adaptability and also for the facilities of concentration which they afford. Similarly methods of maceration, percolation and precipitation have been used to separate the soluble from the insoluble constituents of the drugs. Satvas (सत्व) are instances of such preparations.

Whole drugs were used by the Ayurvedists of the olden times for reasons not only pharmacological and economical but also social i. e. relating to the tastes, habits, customs, and social conditions obtaining then in the country. It must be admitted that strides of civilization have always something to do with the turn of mind of particular generations; yet we cannot ignore the fact that the system had grown in India on account of both extraneous circumstances and intrinsic virtues. So far as the scientific methods are concerned, it may be said that the पांचभौतिक Panchabhautika character of द्रव्यs prominently occupied the minds of the Ayurvedists, and not the analytic and synthetic methods of the West, as the latter, though practical, could not satisfy the basic [आरंभक] theories of the orientals. "It is the character of the Western intelligence to analyse, separate and combine", but this process is sometimes too elaborate and the results obtained are sometimes time-serving, There is also a tendency to artificialise, which makes the subject more and more complex. The motto of the West is to find out drugs or remedies which have a specific property capable of a sure and rapid action. These tendencies, though useful in

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serving one purpose, are not free from the faults of commission and omission. In this connection Wagbhat observes :

शोधनत्वतियोगेन विपरीतं विपर्यये ।
क्षिणुयान्नमलानेव केवलं वपुरस्यति ॥ [सू. अ.१२ श्लो.७२]

Translation: Conversely, an excess of (correction by) elimination leads to undesirable reverses : for such an elimination may not only remove the excretion but also cause harm to the body.

Thus both the systems have got their own merits and defects. A tactful appreciation of the particular system under particular circumstances is what is desired. The subtleties of the ancients though logically correct cannot always be useful in regular practice. Sushruta gives a note of warning and makes the problem clearer. Even then the precautions of the older school serve as guard-stones and prevent precipitate action. To quote an instance of the gravity and depth of the statements of the older philosophers we give below an aphorism :

अनेक द्रव्यवत्त्वेन द्रव्यत्वमुक्तम् । सामान्य विशेषाभावेन च ॥
[वैशेषिक सूत्र बुक २],

The substance of this aphorism is : the eternality of a द्रव्य Dravya is obtained simply from its being a genus, and hence Dravya as it exists is different from a whole Dravya made up of parts. 'Substance-ness' is distinct from substance, attribute and action, by reason of the absence of genera-species in it. Again न द्रव्यं कार्यं कारणं च बधति ॥. [वैशेषिक सूत्र १-१-१२]

Translation: Substance is not annihilated either by its (own) effect or by its (own) cause, but it is only destroyed by the destruction of the support or substratum and the destruction of the originative conjunction. (Vaisheshik Sutra 1 1-12).

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Forms of Preparations. (Ayurvedic)

A पंचकषाय

अथातः स्वरसः कल्कः क्वाथश्च हिमफांटकौ ।
ज्ञेयाः कषायाः पंचैते लघवः स्युर्यथोत्तरम् ॥

(शा. सं.)

Translation: These are the extracts of some of the proximate principles of drugs, in varying proportions. They are enumerated in the descending order of the strengths of their principles.

1. स्वरस

अहतात्तत्क्षणाकृष्टात् द्रव्यात्क्षुण्णात्समुद्धरेत् ।
वस्त्रनिर्पीडितो यः स रसः स्वरस उच्यते ॥ (शा. सं.)

Translation: 'Svarasa' is the juice which is obtained from a green medicinal plant by pounding it and then straining the liquid through a clean linen. One should see beforehand that the plant is not infested with worms and / or injured by inclemencies of weather.

When fresh drugs are not available, the following is the way in which the juices should be extracted.

कुडवं चूर्णितं द्रव्यं क्षिप्तं च द्विगुणेजले ।
अहोरात्रं स्थितं तस्माद्भवेद्वा रस उत्तमः ॥ (शा सं.)

Translation: In the case of plants like गुडूचि whose juice cannot be extracted water should be added to the pounded drug in the proportion of 2 : 1, and kept for a day and a night ; the mixture should then be strained and the solution used.

2. कल्क :

द्रव्यमार्द्रं शिलापिष्टं शुष्कं वा सजलं भवेत् ।
प्रक्षेपावापकल्कास्ते तन्मानं कर्षसंमितम् ॥

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कल्के मधु घृतं तैलं देयं द्विगुणमात्रया ।
सितागुडौ समौ दद्याद्द्रवा देयाश्चतुर्गुणाः ॥ [पंचकषाय.प्र.नि.र.]

Translation : This is simply a mass of drug-fresh or dry-finely pounded, moistened with water, if necessary, and made into a ball or a viscous lump. When honey, ghee, or oil is to be added to the mass, it should be double the quantity of the drug. But in the event of the addition of sugar or jaggery the proportion should be equal, and when liquids are to be added they should be four times the mass.

३. क्वाथ Decoction.

पानीयं षोडशगुणं क्षुण्णे द्रव्ये पले क्षिपेत् ।
मृत्पात्रे काथयेद्ग्राह्यमष्टमांशावशेषितम् ॥
तज्जलं पाययेद्धीमान्कोष्णं मृद्वग्निसाधितम् ।
शृतः क्वाथः कषायश्च निर्व्यूहः स निगद्यते ॥
आहाररसपाके च संजाते द्विपलोन्मितम् ।
वृद्धवैद्योपदेशेन पिबेत्क्वाथं सुपाचितम् ॥
[नि र. पंच. कषाय प्र]

प्रक्षेप

क्वाथे क्षिपेत्सितामंशैश्चतुर्थाष्टमषोडशैः ।
वातपित्तकफातङ्के विपरीतं मधु स्मृतम् ॥
जीरकं गुग्गुलं क्षारं लवणं च शिलाजतु ।
हिंगु त्रिकटुकं चैव क्वाथे शाणोन्मितं क्षिपेत् ॥
क्षीरं घृत गुडं तैलं मूत्रं चान्यद्द्रवं तथा ।
कल्कं चूर्णादिकं क्वाथे निक्षिपत्कर्षसंमितम् ॥ [पं.क.प्र.नि.र.]

Translation : The drugs should first be cut into small pieces, or they should be pounded, if necessary. These should then be boiled over a slow fire. As a general rule, one part of the vegetable substances should be boiled in sixteen parts of

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water till only a fourth of it remains in the vessel. The liquid should then be strained. When decoctions are made of dry substances eight parts of water may be used. Decoctions are administered with vehicles like salt, honey, sugar, treacle, alkaline ashes, ghee, oil, or some medicinal powder as the case may require.

सप्तविधकषाय

पाचनो दीपनीयश्च शोधनः शमनस्तथा ।
तर्पणः क्लेदनः शोषी क्वाथः सप्तविधः स्मृतः ॥
पाचनोऽद्धविशेषी स्याच्छोधनो द्वादशांशकः ।
क्लेदनश्चतुरंशश्च शमनोऽष्टावशेषितः ॥
दीपनीयो दशांशस्तु तर्पणश्च समांशकः ।
विशोषी षोडशांशश्च क्वाथभेदाः प्रकीर्तिताः ।

(हा. सं.) स्थान ३ अ. १

Their action :

पाचनः पचते दोषान् दीपनो दीप्यते मलान् ।
शोधनो मलशोधीस्याच्छमनः शमते गदान् ॥
तर्पणस्तर्पते धातून्क्लेदी हृत्क्लेदकारकः ।
विशोषी शोषमाधत्ते तस्मात्क्वाथं परीक्षयेत् ॥

(हा. सं) स्थान ३ अ. १

Translation : These are decoctions of different strengths. Their names are 1. पाचन 2. दीपन 3. शोधन 4. शमन 5. तर्पण 6. क्लेदन 7. विशोषी

1. पाचन is a decoction in which the solution is reduced to one-half of the total quantity. It digests the आमदोष.

2. दीपन is a decoction in which the solution is reduced to one-tenth. It stimulates excretion.

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3. शोधन (Shodhana) is that type of decoction in which the solution is reduced to one-tweflth of the total quantity. It eliminates excretion.

4. शमन (Shamana) is a decoction in which the solution is reduced to one-eighth. It modifies the severity of the disease.

5. तर्पण (Tarpana) is a decoction in which the solution is boiled till it reaches the boiling-point. It nourishes the धातुs (tissues).

6. क्लेदन (Kledana) is a decoction in which the solution is reduced to one-forth. It causes-disquietude-distress to the heart.

7. विशोषी (Vishoshee) is also a decoction in which the solution is reduced to one-sixteenth. It causes thirst.

General Instructions regarding the preparation of Decoctions :

न शोषयेत्पुनः क्वाथं नच भूमिगतं पुनः ।
दोषसंशमने नैते प्रशस्तागदकर्मणि ॥
कृष्णं नीलं घनं रक्तं पिच्छिलं शिथिलं च यत् ।
दग्धं कुणप-गंधं च विस्र-गंधं विवर्जयेत् ॥
द्रव्यं गुणानुवर्णेन द्रव्यगंध विनिर्दिशेत् ।
तद्वद्विशुद्धं संच्छायं कषायममृतोपमम् ॥

—हा. सं. ch. I स्थान ३

Translation : A decoction should not be allowed to evaporate after the proper strength is reached, nor should it be boiled again after being once taken off the fire and placed on the ground.

A decoction should be rejected when

(a) it assumes a dark, blue or red colour.

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(b) it becomes thick, slimy, or weak.

(c) it is over-boiled.

(d) it emits a raw or rotten fleshy smell.

The odour of the decoction should be of the nature of the drugs used, and its appearance pure on lustrous.

4. फांट Infusion in hot water.

क्षुण्णे द्रव्यपले सम्यग्जलभुष्णं विनिक्षिपेत् ।
मृत्पात्रे कुडवोन्मानं ततस्तु स्रावयेत्पटात् ॥
स स्याच्चूर्णद्रवः फांटस्तन्मानं द्विपलोन्मितम् ।
मधुश्वेतागुडादींश्च काथवत्तत्र निक्षिपेत् ॥
(शां. सं.) नि. र. पं. क. प्र.

Translation: This is prepared by steeping (for twelve hours) pounded drugs in fresh boiled water. The quantity of the boiled water should be four times that of the drugs. The vessel used should be earthen. The fluid decanted from this vessel after the stated period is called फांट (phanta). It should be used in the same way as decoctions. The dose is eight tolas

5. हिम Infusion in cold water.

क्षुण्णं द्रव्यपलं सम्यक् षड्भिर्नीरपलैः प्लुतम् ।
निशोषितं हिमः स स्यात्तथा शीतकषायकः ।
तन्मानं फांटवज्ज्ञेय सर्वत्रैष विनिश्चयः ॥ (शा. सं.)
नि. र. पे. क. प्र.

Translation : These are prepared by steeping powdered drugs in cold water. Six parts of cold water are needed for one part of drugs. The steeping should continue for one whole night,

The dose and the method of preparation are the same as in the case of फांट (phanta),

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(b) मंथ A variety of cold infusion.

जले चतुः पले शीते क्षुण्णं द्रव्यपलं क्षिपेत् ।
मृत्पात्रे मंथयेत्सम्यक् तस्माच्च द्विपलं पिबेत् ॥ (शा. सं.)
नि. र. पं. क. प्र.

Translation : This is an emulsion of one part of drugs in fine powder with four parts of cold water. An earthen vessel should be used. The dose is eight tolas.

(c) तंडुलजल Rice Water (washings).

कंडितं तंडुलपलं जलेऽष्टगुणिते क्षिपेत् ।
भावयित्वा जलं ग्राह्यं देयं सर्वत्र कर्मसु ॥
(नि. र. सा. प. पंचकषाय प्रकरण)

Translation : This is prepared by thoroughly mixing with the hand one part of rice with eight parts of water.

6. पानीय A weak form of decoction.

क्षुण्णं द्रव्यपलं साध्यं चतुःषष्टिपलेऽबुनि ।
अर्धशिष्टं च तद्देयं पाने भक्तादिसंविधौ ॥ (शा. सं.)
द्वि. खं. Art. 95

Translation : One part of medicinal substance should be boiled in sixty-four parts of water till the water is reduced to half the quantity. It should be strained and given to patients when they feel very thirsty. This preparation can be given during meals.

7. प्रमथ्या

प्रमथ्या प्रोच्यते द्रव्यपलात्कल्कीकृताच्छृतात् ।
तोयेऽष्टगुणिते तस्याः पानमाहुः पलद्वयम् ॥ (नि. र.)

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Translation : One part of the drug is first ground into a pulp, and the pulp, so formed, is boiled in eight parts of water till the liquid is reduced to a fourth of its measure. The dose is eight tolas.

8. क्षीरपाक Decoction in milk.

द्रव्यादष्टगुणं क्षीरं क्षीरात्तोयं चतुर्गुणम् ।
क्षीरावशेषः कर्तव्यः क्षीरपाके त्वयं विधिः ॥

शा. सं. खं. द्वि. अ. २

Translation : One part of the medicine is boiled in eight parts of milk with the addition of thirty-two parts of water. The boiling is continued till the water is evaporated and milk alone is left.

9. मंड, पेया, विलेपी, यवागू

Sushruta explains the difference between these briefly thus:

सिक्थैर्विरहितो मंडः पेया सिक्थसमन्विता ।
विलेपी बहुसिक्था स्यांद्यवागूर्विरलद्रवा ॥ सूत्र अ. ४६

—सुश्रुत Arti 345.

Translation : मंड (Manda), when ready, is completely free from the grain (rice), पेया (Peya) is a little mixed with the grain; विलेपी (Vilepee) is thickly mixed with the grain and is therefore viscous; and यवागू (Yawagoo) becomes so thick that the liqaid portion is scarcely left in it.

Sharangdhar [शार्ङ्गधर] explains these preparations in detail. The proportion of water (to be mixed) in each preparation is given as under:

In the case of Manda, fourteen parts of water are added to one part of the cereal, usually rice or लाज.

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In the case of Peya or Yoosha, the same quantity of water as in the preparation of Manda is taken, but the preparation is allowed to boil till the consistency gets thicker than that of Manda. Yoosha is a bit thicker than Peya.

In the case of Vilepee, the quantity of water is four times that of the cereal and the mixture is boiled till it becomes viscous.

In the case of Yavagoo, the quantity of water is six times that of the stuff taken and the whole is boiled till it gains the consistency of gruel. Rice, Phaseolus Radiata [माष], Phaseolus Mungo [मुद्ग], and sesamum are generally used in this preparation.

10. लेह and अवलेह. Thickened Extracts approaching confections.

काथादीनां पुनः पाकाद् घनत्वं सा रसक्रिया ।
सोऽवलेहश्च लेहः स्यात् तन्मात्रा स्यात्पलोन्मिता ॥
सिता चतुर्गुणं कार्या चूर्णाच्च द्विगुणो गुडः ।
द्रवं चतुर्गुणं दद्यादिति सर्वत्र निश्चयः ॥
सुपक्वे तंतुमत्त्वं स्यादवलेहोऽम्बु मज्जति ।
खरत्वं पीडिते मुद्रागंधवर्णरसोद्भवः ॥
दुग्धमिक्षुरसं यूषं पंचमूल कषायजम् ।
वासाक्वाथं यथायोग्यमनुपानं प्रशस्यते ॥

Translation: In this preparation, decoctions are boiled down to a thick consistency. The dose generally prescribed is four tolas. If sugar is to be used in this preparation, its quantity should be four times that of the drugs, and in the case of jaggery it should be double that of the drugs. If water, or milk, or cow's urine is to be used-added, the quantity to be added should be four times that of the drugs used.

A good confection should sink in water and be ductile. If t is made thicker, it should be able to receive impressions. It

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should show a good colour and emit sweet smell. The preparation is recommended to be taken with milk, sugar-cane juice or any other infusion or decoction desirable under the circumstances.

11. पुटपाक A process of roasting within a closed cover.

पुटपाकस्य मात्रेयं लेपस्यांगारवर्णता ॥
लेपं च द्वयंगुलं स्थूलं कुर्याद्वांगुष्ठमात्रया ।
काश्मरीवटजम्बादिपत्रैर्वेष्टनमुत्तमम् ॥
पलमात्ररसो ग्राह्यः कर्षमात्र मधु क्षिपेत् ।
कल्कचूर्णद्रवाद्यास्तु देयाः स्वरसवद्बुधैः ॥

(पंच. कषाय. प्र. नि. र.)

Translation : In this process drugs are reduced to a pasty mass which is then wrapped up in the leaves of either Jambu, Vata, Kasmari etc., firmly tied with a thread or vegetable fibre, covered with a layer of clay from ½″ to 1″ in thickness and roasted over fire made of cow-dung-cakes. When the layer of clay assumes a brick-red colour roasting is known to be complete. The ball, now, is withdrawn from the fire and broken open. The juice of the roasted drugs is given with honey, or sometimes the roasted drug is given itself in the form of powder or pill. The dose is four tolas.

12. खंडपाक Confection.

These are made by adding powdered medicines to syrup & gently stirring the latter over a slow fire till it is intimately mixed and is reduced to a proper consistency. The dose is generally one tola. They are generally recommended to be taken with milk.

13. चूर्ण Powders.

अत्यन्तशुष्कं यद्द्रव्यं सुपिष्टं वस्त्रगालितम् ।
तत्स्याच्चूर्णं रजः क्षोदस्तन्मात्रा कर्षसंमिता ॥

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चूर्णे गुडः समो देयः शर्करा द्विगुणा भवेत् ।
चूर्णेषु भर्जितं हिंगु देयं नोत्क्लेदकृद्भवेत् ॥
लिहेच्चूर्णं द्रवैः सर्वैर्घृताद्यैर्द्विगुणोन्मितैः ।
पिबेच्चतुर्गुणैरेव चूर्णमालोडितं द्रवैः ।
(पंच कषाय प्र. नि. र.) p. 385

Translation : These are powders prepared by pounding dry substances in a mortar with a pestle and passing the powder through linen.

If jaggery is to be mixed with the powder, it should be equal to the Churna and in the case of suger it should be double the Churna. If asafoetida is to be mixed, it should always be baked over fire to prevent nausea.

When ghee, oil, or honey is to be used as a vehicle, it should be double the Churna in quantity, and when milk, water cow's urine etc. are to be used, they should be four times in quantity.

14 भावना

द्रव्येण भावना सम्यक्चूर्णं सर्वप्लुतं भवेत् ।
भावनायाः प्रमाणं तु चूर्णे प्रोक्तं भिषग्वरैः ॥

Explanation: Powders are soaked in various fluids, such as the expressed juice of herbs, decoctions etc., and then dried. For this purpose the quantity of the juice added to the powder should be sufficient to cover it. The mixture is then allowed to dry in a shaded place. This process is repeated twice, thrice or as many times as is necessary.

15 वटक (Pill), गुटिका (Pill) and मोदक (Bolus).

वटकाश्चाथ कथ्यन्ते तन्नाम गुटिका वटी ।
मोदको वटिका पिंडी गुडो वर्तिस्तथाच्यते ॥
लेहवत्साध्यते वह्नौ गुडो वा शर्कराऽथवा ।
गुग्गुलुर्वा क्षिपेत्तत्र चूर्णं तन्निर्मिता वटी ॥

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कुर्याद्वह्निसिद्धेन क्वचिद्गुणुलुना वटीम् ।
द्रवेण मधुना वाऽपि गुटिकां कारयेद्बुधः ।
सिता चतुर्गुणा देया वटीषु द्विगुणो गुडः :
चूर्णाच्चूर्णसमः कार्यो गुग्गुलुर्मधु तत्समम् ॥
द्रवंच द्विगुणं देयं मोदकेषु भिषग्वरैः ॥
कर्षप्रमाणा तन्मात्रा बलं दृष्ट्वा प्रयुज्यताम् ॥

(पं. क. प्र. नि. र.) P. 385

Translation: (i) Vataka (Pill): These are prepared by first making a decoction of medicinal substances and then boiling it down to a thick consistency and adding some powders of drugs for making a pill-mass. Sometimes treacle or honey is added to it.

(ii) Gutika—implies large pills or boluses. The method of preparation is just the same as in the case of Vataka.

(iii) Modaka—implies a bolus larger than Gutika. Medicinal substances reduced to powders are added to cold syrups and stirred with it till the two are uniformly mixed. No boiling is required in this preparation. Syrup should be made with sugar and water, or with sugar and a decoction of the prescribed drugs.

16. आसव and अरिष्ट Medicated spiritnous liquors.

द्रवेषु चिरकालस्थं द्रव्यं यत्सधितं भवेत् ।
आसवारिष्टभेदैस्तत्प्रोच्यते भेषजोचितम् ॥
यदपक्वौषधाम्बुभ्यां सिद्धं मद्यं स आसवः ।
अरिष्टः क्वाथसिद्धः स्यात्तयोर्मानं पेलोन्मितम् ॥
अनुक्तमानारिष्टेषु द्रवद्रोणे तुलां गुडम् ।
क्षौद्रं क्षिपेद्गुडादर्धं प्रक्षेपं दशमांशकम् ॥

(पंच कषाय प्र. नि र.) p. 368

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Explanation : 'Asavarishta' implies medicated spirituous liquors. These are prepared from medicinal substances with the addition of honey, treacle etc. The usual proportion of the ingredients is

	Water	Jaggery	Honey	M. Herbs
Tolas	1024.	400.	200.	40.

The ingredients are placed in earthen vessels and allowed to ferment. When raw vegetable- juices are used the resulting liquid is called 'Asava' and when decoction of the drugs are used, the fermented product is called 'Arishta'. These preparations virtually operate as mild wines and possess the virtues of the drugs which have entered into their composition. Many of them are stomachics, stimulants, tonics, astringents, alteratives, febrifuges etc.

17. सीधु

ज्ञेयः शीतरसः सीधुरपक्वमधुरद्रवैः ।
सिद्धः पक्वरसः सीधुः संपक्वमधुरद्रवैः ॥
(पं. क. प्र. नि. र.) p. 386

Translation : Wines are the products of fermentation of raw or boiled juices of plants, or their parts.

18. सुरा, सुरामंड, कादंबरी, जगल, मेदक, सुराबीज.

These comprise medicines that are the products of fermentation. The following are the different forms of wines that are mentioned in the Ayurvedic literature.

परिपक्वान्नसंधानसमुत्पन्नां सुरां जगुः ।
सुरामंडः प्रसन्ना स्यात्तत कादंबरी घना ॥
तदधो जगलो ज्ञेयो मेदको जगलाद्घन ।
पक्वोऽसौ हृतसारः स्यात्सुराबीजं च किण्वकम् ॥ (नि. र.)

वारुणी यत्तालखर्जूररसैः सन्विता सा हि वारुणी ॥ (नि. र.)

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सूक्त, शुक्त { कन्दमूलफलादीनि सस्नेहलवणानि च ।
यत्र द्रवेऽभिषूयन्ते तत्सूक्तमभिधीयते ॥ (नि. र)

चुक्र { विनष्टमम्लतां यातं मधु वा मधुरद्रवः ।
विनष्टः सन्धितो यस्तु तच्चुक्रमभिधीयते ॥ (नि र.)

गुडसूक्त, इक्षुसूक्त { गुडांबुना सतैलेन कंदमूलफलैस्तथा ॥
सन्धितं चाम्लतां यातं गुडसूक्तं तदूच्यते ।
एवमेवेक्षुसूक्तं स्यान्मृद्वीकासंभवं तथा ॥ (नि. र.)

कांजिक { संधितं धान्यमंडादि कांजिकं कथ्यते जनैः ।
कांजिकं भेदि तीक्ष्णोष्णं रोचनं पाचनं लघु । (भा. प्र)

तुषांबु { तुषोदकं यवैरामैः सतुषैः शकली कृतैः
तुषांबु दीपनं हृद्यं पांडुकृमि गदापहम्
तीक्ष्णोष्णं पाचनंपित्तरक्तकृद्वस्तिशूलनुत्

सौवीर { सौवीरन्तु यवैरामैः पक्वैर्वा निस्तुषी कृतम्
गोधूमैरपि सौवीरमाचार्याः केचिदूचिरे

आरनाल आरनालं तु गोधूमैरामै स्यान्निस्तुषीकृतैः (भा. प्र)

धान्याम्ल { धान्याम्लं शालिचूर्णं च कोद्रवादि कृतं भवेत्
धान्याम्लं धान्ययोनित्वात्प्रीणनं लघु दीपनम्

संडाकी or शुंडाकी { अरुचौ वातरोगेषु सर्वेष्वास्थापने हितम् (भा प्र.)
संडाकी संधिता ज्ञेया मूलकैः सर्षपादिभिः । शा. सं.

19 वेसवार A type of medicinal spices containing aromatic drugs.

त्र्यूषणं जीरकं द्वंद्वं शतुपुष्पा च धान्यकम् ।
त्वगेला पत्रकं नागकेसरं च तिलांस्तथा ॥
दाडिमत्वङ निशा कासमर्द पत्राणि हिंगुकम् ।
रुक्षंचार्द्र तारिकेलं सिद्धार्थैरंड मूलकम् ॥
बृहद्रक्तं च मरिचं द्वाविंशं वाफली फलम् ।
एते सर्वे यथायोग्यं घृतेभर्ज्य विचूर्ण्य च ॥

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17. सीधु

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पक्वोऽसौ हृतसारः स्यात्सुराबीजं च किण्वकम् ॥ (नि. र.)

वारुणी यत्तालखर्जूररसैः सन्विता सा हि वारुणी ॥ (नि. र.)

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चुक्र { विनष्टमम्लतां यातं मधु वा मधुरद्रवः ।
विनष्टः सन्धितो यस्तु तच्चुक्रमभिधीयते ॥ (नि र.)

गुडसूक्त, इक्षुसूक्त { गुडांबुना सतैलेन कंदमूलफलैस्तथा ॥
सन्धितं चाम्लतां यातं गुडसूक्तं तदूच्यते ।
एवमेवेक्षुसूक्तं स्यान्मृद्वीकासंभवं तथा ॥ (नि. र.)

कांजिक { संधितं धान्यमंडादि कांजिकं कथ्यते जनैः ।
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तुषांबु { तुषोदकं यवैरामैः सतुषैः शकली कृतैः
तुषांबु दीपनं हृद्यं पांडुकृमि गदापहम्
तीक्ष्णोष्णं पाचनंपित्तरक्तकृद्वस्तिशूलनुत्

सौवीर { सौवीरन्तु यवैरामैः पक्वैर्वा निस्तुषी कृतम्
गोधूमैरपि सौवीरमाचार्याः केचिदूचिरे

आरनाल आरनालं तु गोधूमैरामै स्यान्निस्तुषीकृतैः (भा. प्र)

धान्याम्ल { धान्याम्लं शालिचूर्णं च कोद्रवादि कृतं भवेत्
धान्याम्लं धान्ययोनित्वात्प्रीणनं लघु दीपनम्

संडाकी or शुंडाकी { अरुचौ वातरोगेषु सर्वेष्वास्थापने हितम् (भा प्र.)
संडाकी संधिता ज्ञेया मूलकैः सर्षपादिभिः । शा. सं.

19 वेसवार A type of medicinal spices containing aromatic drugs.

त्र्यूषणं जीरकं द्वंद्वं शतुपुष्पा च धान्यकम् ।
त्वगेला पत्रकं नागकेसरं च तिलांस्तथा ॥
दाडिमत्वङ निशा कासमर्द पत्राणि हिंगुकम् ।
रुक्षंचार्द्र तारिकेलं सिद्धार्थैरंड मूलकम् ॥
बृहद्रक्तं च मरिचं द्वाविंशं वाफली फलम् ।
एते सर्वे यथायोग्यं घृतेभर्ज्य विचूर्ण्य च ॥

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यथायोग्यं मेलिताश्चेद्वेसवारः सवातहा ।
यस्मिन् पदार्थे दत्तोयं सोऽग्नेर्वीर्यस्य वर्धकः ॥

नि. र. old Edition 1867.

20 तैल, घृतः Oils, Ghees etc.

General instructions regarding the preparat ion of oils and ghritas :

कल्काच्चतुर्गुणीकृत्य घृतं वा तैलमेव वा ।
चतुर्गुणे द्रवे साध्यं तस्य मात्रा पलोन्मिता ॥
निक्षिप्य क्वाथयेत्तोयं क्वाथ्यद्रव्याच्चतुर्गुणम् ।
पादाशिष्टं गृहीत्वा च स्नेहं तेनैव साधयेत् ॥
चतुर्गुणं मृदुद्रव्ये कठिने ऽ ष्टगुणं जलम् ।
तथा च मध्यमद्रव्ये दद्यादष्टगुणं पयः ॥
अत्यतकाठने द्रव्ये नीरं षोडशिकं मतम् ।
कर्षादितः पलं यावत्क्षिपेत्वोडशिकं जलम् ॥
तदूर्ध्वं कुडवं यावत्क्षिपेदष्टगुणं पयः ।
प्रस्थादितः क्षिपेन्नीरं खारी यावच्चतुर्गुणम् ॥
अम्बुक्वाथरसैर्यत्र पृथक्स्नेहस्य साधनम् ।
कल्कस्यांशं तत्र दद्याच्चतुर्थं षष्ठमष्टमम् ॥
दुग्धे दाध्नि रसे तक्रे कल्को देयोऽष्टमांशकः ।
कल्कस्य सम्यक्पाकार्थं तोयमत्र चतुर्गुणम् ॥
द्रवाणि यत्र स्नेहेषु पंचादीनि भवंति हि ।
तत्र स्नेहसमान्याहुर्यथापूर्वं चतुर्गुणम् ॥
द्रवेण केवलेनैव स्नेहपाको भवेद्यदि ।
तत्रांबुपिष्टः कल्कः स्याज्जलं चात्र चतुर्गुणम् ।
क्वाथेन केवलेनैव पाको यत्रेरितः क्वचित् ॥
क्वाथ्यद्रव्यस्य कल्कोऽपि तत्र स्नेहे प्रयुज्यते ।
कल्कहीनस्तु यः स्नेहः ससाध्यः केवलद्रवे ॥

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पुष्पकल्कस्तु यः स्नेहस्तत्र तोयं चतुर्गुणम् ।
स्नेहे स्नेहाष्टमांशश्च पुष्पकल्कः प्रयुज्यते ॥ (शा. सं.)
[द्वि. खं. अ ९]

Translation : These are, in a way, decoctions of vegetable drugs made with the addition of oil or ghee, and form a prominent feature of ayurvedic practice. Many varieties of them are prepared and these are used both internally and externally. The ghees are chiefly used internally and the oils generally externally.

Preparation: The menstruum in which these medicinal ghees or oils are prepared may consist of water alone or of decoction or of expressed juice of vegetable drugs. As a general rule, the proportion of the different ingredients used is as follows : Medicinal substances well-pounded with the addition of water so as to form a pasty mass, one part; ghee or oil, four parts; and water, expressed juice, or decoction, sixteen parts. These are boiled till the whole of the watery portion is evaporated and nothing but oil remains.

When decoctions are to be used as menstruum the proportion of drugs to water, in ordinary cases, should be one to four: and the mixture should be boiled till it is reduced to one-fourth of its measure. But when the drugs ase hard, woody, or difficult to be easily dissolved, additional quantities of water have to be taken to prepare the decoction. So, in the case of soft, medium, and hard drugs the proportions of water should be four, eight, and sixteen respectively to one of the drugs.

When decoctions used for menstruums are required on a larger scale, the proportion of water taken to prepare those decoctions goes on decreasing. The proportions are as follows:

Quantity of Decoction (ready)	Proportion of Water.
1 to 4 tolas.	16 times.
4 to 16 ,, ...	8 times.
16 to 16384 ,, ...	4 times.

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When the स्नेह (Sneha) is to be prepared with either water or some such fluid as decoction, expressed juice, milk, butter-milk, etc., the proportions should be as under :

(Kalka)—Pasty mass.	Medicated Oil or Ghee.	(Fluid).
1	4	16. Water
1	6	24. Decoction
1	8	32. Meat juice
1	8	32. Milk, Curds Etc.

N.B. In the case of the last two, additional water to the extent of four times the स्नेह (Sneha) may be added, if necessary.

When more than one variety of fluids are required, then up to four such sorts the usual proportion of four parts of fluid to one of Sneha should be taken, and the varieties should be boiled separately. But when the number of fluids required exceeds four, each of the fluids should be equal in quantity to the Sneha, and all should be mixed and boiled together.

When the Sneha is intended to be prepared in decoction only, the pounded mass, left after the decoction is strained, may also be added to the mixture before it is boiled. But when it is expressly desired that the remains (Kalka) of decoction are not wanted, they should be discarded.

When flowers are to be used in the preparation of the Sneha the proportion of flowers, oil and water should be 1 : 8 : 4.

(II) घृतपाक (Ghrita-paka) and तैलपाक (Taila-paka).

वर्तिवत्स्नेहकल्कः स्याच्चदाऽङ्गुल्या विमर्दितः ।
शब्दहीनोऽग्निनिक्षिप्तः स्नेहः सिद्धो भवेत्तदा ॥
यदाफेनोद्भवस्तैले फेनशान्तिश्च सर्पिषि ।

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गन्धवर्गरसोत्पत्तिः स्नेहसिद्धिस्तदा भवेत् ॥
स्नेहपाकस्त्रिधा प्रोक्तो मृदुर्मध्यः खरस्तथा ।
ईषत्सरसकल्कस्तु स्नेहपाको मृदुर्भवेत् ॥
मध्यपाकस्य सिद्धिश्च कल्के नीरसकोमलः ।
ईषत्कठिनकल्कश्च स्नेहपाको भवेत्खरः ॥
तदूर्ध्वं दग्धपाकः स्याद्दाहकृन्निष्प्रयोजकः ।
आमपाकश्च निर्वीर्यो वह्निमान्द्यकरो गुरुः ॥
नस्यार्थे स्यान्मृदुः पाको मध्यमः सर्वकर्मसु ।
अभ्यङ्गार्थे खरः प्रोक्तो युंजादेवं यथोचितम् ॥
घृततैलगुडादींश्च साधयेन्नैकवासरे ।
प्रकुर्वन्त्युषिता ह्येते विशेषाद्गुणसंचयम् ॥

(शा. सं.) (द्वि. खं. अ. ९) p. 386 नि. र.

(a) **Preparation of Medicated Ghrita :**

Clarified butter is first of all heated on fire so as to deprive it of any water that may be mixed with it. A little turmeric juice is then added to it to purify it. Ghrita thus purified is placed on fire in an earthen, copper or iron pan and melted with gentle heat. Then the medicinal paste Kalka) and the fluids to be used are added, and the whole boiled together till the watery portion is evaporated and the ghrita becomes free from froth. It is then strained through cloth and preserved for use. The ghrita thus prepared should have the colour, taste and odour of the medicines used. Sufficient time should be allowed for the process to be completed so that the active principles are well extracted. The boiling process through which the preparation of ghrita is passed is, generally, either मृदु (mild), मध्यम (intermediate) and खर (overdone). The mild is suitable for use as snuff, the intermediate is preferred for internal administration and injection into the rectum, while the overboiled form is used for external application.

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(b) **Preparation of Medicated Oils :**

In preparing these sesamum oil is used unless otherwise specified. The purification of sesamum oil is as follows : The oil is first heated in order that it should get rid of the water contained in it, and then the following substances are steeped in it for twenty-four hours : मंजिष्ट (Manjishta) 1/6 th part in weight of the oil ; हरिद्रा (Haridra), लोध्र (Lodhra), मुस्तक (Mustaka), नलिका (Nalika), त्रिफला (Trifala), वालक (Walaka), and केतकी (Ketaki), each 1/64th part in weight of the oil. A little water is added to this oil and the water is kept for a day. The mixture is then boiled till the water is evaporated and finally strained. To the oil thus prepared, medicinal substances in the form of कल्क (Kalka) or कषाय (Kashaya) are added, if necessary. They are then boiled together till the watery parts are evaporated. When cooled, the oil is strained and kept for use.

गधपाक (Gandhapaka).

To render the oil fragrant the following substances are used :

1. एला Elletteria Cardamomum
2. त्वक् Cinnamomum Zeylanicum.
3. लवंग Eugenia Caryophyllata.
4. केशर Crocus Sativus.
5. तमालपत्र Cinnamomum Tamal.
6. श्रीगंध Santalum Alba.
7. कुमारी Aloe Vera,
8. जटामांसी Valeriana Jatamansi.
9. शठी Curcuma Zedoaria.
10. मुस्तक Cyperus Rotundus.
11. कंकोल Piper Cubeba.
12. गंधाबिरोजा Boswellia Serrata.

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13. उस्तुरक् Storax Officinalis. 14. पिप्पलीमूल Root of Piper Longum.
15. उशीर Andropogon Muricatus. 16. नखी Unguis Odoratus.
17. स्वत्तासी Pouch of Civet cat. 18. कर्पूरवल्ली Anisochilus Carnosus.
19. कस्तूरी Preputial dried Secretion of musk animal. 20. शैलेय Permelia Pelata (Lichen.)
21. कुष्ट Saussurea Lappa. 22. लताकस्तूरी Hibiscus Abelmos-Chus.

For four seers of the oil (one seer according to the Southern-India physicians is equal to eighty tolas, but Bengal-Physicians take sixty-four tolas for a seer) one tola of each of the ingredients should be taken, with the exception of camphor which should be four tolas.

Camphor, musk, storax and नखी (Nakhi) should be added after the process of गंधपाक (Gandhapaka) is over.

Castor oil and mustard oil are sometimes used in the preparation of medicated oils, the proportion of the oil, the drugs and the fluids being the same as that when sesamum oil is used. The purification of mustard-oil is as follows :

To four seers of the oil sixteen tolas of मंजिष्ट (Rubia Cordifolla) and two tolas of each of बिभीतक (Bellerica.), हरिद्रा (Turmeric). मुस्तक (Cyperus Rotundus), बिल्वमूल (Root of Aegle Marmelos.) दाडिमत्वक् (Bark of Punica Granatum), नागकेसर (Mesua Ferrea.) कृष्णजीरक (Nigella Sativa.), वालक (Andropogon Muricatus,) and धात्री (Emblica Phyllanthus.) are added. These should be boiled together with sixteen seers of water till the latter is evaporated. The oil should then be strained and brought into use.

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To purify a Castor-oil the following ingredients are used:-

1. मंजिष्ट Rubia Cordiafolia. 2. मुस्तक Cyperus Rotundus.
3. धान्यक Coriander Fructus. 4. त्रिफला Three Myrobalans.
5. वैजयंति Sesbania Aculeata. 6. व्हीबेर Pavonia Odorata.
7. वनखर्जूर 8. वटसुंग
9. हरिद्रा Curcuma Longa. 10. दारुहरिद्रा Berberis Aristata.
11. नलिका Onasma Echoides. 12. शुंठी Zingiber Officinale.
13. केतकी Pandanm Odoratissimus.

each half a tola for four seers of oil. Castor-oil should be boiled with equal parts of whey and plain conjee (कांजिक) along with other ingredients.

24. द्रावक (Dravaka)—Distilled Mineral Acids.

Dravakas are distilled mineral acids. A number of mineral substances or salts are heated in a covered vessel with a tube joined to it, called a retort. The distilled fluid is collected in a vessel of glass. If a shell or cowrie is dissolved when thrown into it, the preparation is regarded as well-made. There are two varieties of Dravaka, called Swalpa dravaka and Shankha-dravaka

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CHAPTER V

ACTION OF DRUGS.

SECTION I

A. Action of drugs given internally:—

1. दीपन (Deepana).

पचेन्नामं वन्हिकृच्च दीपनं तद्यथा मिशिः । (शा. सं. Ch. IV)

Translation : That drug which does not digest आम (Ama) but only stimulates the gastric nerves to action is called Gastric Stimulant.' Examples: मिशि Foeniculum Vulgare.

Definition of आम (Ama):

उष्मणोऽल्पबलत्वेन धातुमाद्यमपाचितम् ।
दुष्टमामाशयगतं रसमामं प्रचक्षते ॥२५ (वाग्भट. सू. ch 13)

Translation : When, on account of a weak stomach, food is not properly digested and रस (Rasa) is not well-converted but is spoiled either by the excess or the shortage of the digestive juices, it is called आम (Ama).

2. पाचन (Pachana).

पचत्यामं न वन्हिं च कुर्याद्यत्तद्धि पाचनम् । (शा. सं.) Ch. 4

Translation : The drug, which digests आम (Ama) but does not directly stimulate the gastric nerves, is called पाचन (Pachana). Example : नागकेसर (Mesua Ferrea).

The drug, which possesses both the above-mentioned properties is called दीपन-पाचन (Deepana-Pachana). Example: चित्रक (Plumbago Zeylanica).

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3. शमन (Shamana).

न शोधयति यद्दोषान् समान्नोदीरयत्यपि ।
समीकरोति संवृद्धान् शमनं तद्यथाऽमृता ॥
—शा. सं. अ. IV

Translation : A drug like अमृता (Tinospora Cordifolia) is called शमन (Shamana), because it only passifies the tissues when they are excited. It neither corrects the damaged tissues by eliminating the दोषs (Doshas) through the excretory channels, nor strengthens the tissues which are in normal condition.

4. अनुलोमन (Anuloman) :

कृत्वा पाकं मलानां यद्भित्त्वा बन्धमधो नयेत् ।
तच्चानुलोमनं ज्ञेयं यथा प्रोक्ता हरीतकी ॥ (शा. सं अ. IV)

Translation : The drug, which, having first acted chemically upon the मलs facilitates their easy elimination through the natural outlets by breaking through the obstruction, is called अनुलोमन (Anulomana). Example: हरीतकी (Terminalia Chebula).

5. स्रंसन (Sramsana) :

पक्तव्यं यदपक्त्वैव श्लिष्टं कोष्टे मलादिकम् ।
नयत्यधः स्रंसनं तद्यथा स्यात्कृतमालकः ॥ (शा. सं. अ.IV)

Translation : The drug which takes no part in digestion but which drives downwards the products that remain impacted in the intestines is called स्रंसन Example : कृतमालक (Cassia Fistula).

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6. भेदन (Bhedan) :

मलादिकमबद्धं वा यद्बद्धं पिंडितं मलैः ।
भित्त्वाधः पातयति तद्भेदनं कटुकी यथा ॥ (शा. सं. अ. IV)

Translation : That drug is called भेदन (Bhedana) which pushes the excreta downwards, whether they are hard or soft, after breaking down the scybala hardened by वातदोष (Wata-dosha). Example : कटुकी (Picrorriza Kurroa).

7. रेचन (Rechana) :

विपक्वं यदपक्वं वा मलादि द्रवतां नयेत् ।
रेचयत्यपि तज्ज्ञेयं रेचनं त्रिवृता यथा ॥ (शा. सं. अ. IV)

Translation: That drug is called रेचन which liquifies the excreta whether or not they are in a digested condition and expels them out of the intestines. Example : त्रिवृता (Convulvulus Turpethum).

8. वमन (Vamana)—Vomiting.

अपक्वपित्तश्लेष्माणौ बलादूर्ध्वं नयेत्तु यत् ।
वमनं तद्धि विज्ञेयं मदनस्य फलं यथा ॥ (शा. सं. अ. IV)

Translation : That drug which forcibly throws out the bilious matter and the mucus even when the digestive processes are yet incomplete is called वमन. Example. मदनफल (The fruit of Randia Dumetorum).

9. संशोधन (Samshodhana)

स्थानाद्बहिर्नयेदूर्ध्वमधो वा मलसंचयम् ।
देहे संशोधनं तत्स्याद्देवदालीफलं यथा ॥ (शा. सं. अ. IV)

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Translation : That drug which sends up or pushes down the excretory products of digestion after dissolving them from their respective regions is called संशोधन. Example देवदाली. (The fruit of Luffa Echinata).

10. छेदन (Chhedana).

श्लिष्टान्कफादिकान्दोषानुन्मूलयति यद्बलात् ।
छेदनं तद्यवक्षारो मरिचानि शिलाजतु ॥ (शा. सं. अ. IV)

Translation : The drug which forcibly eradicates not only the Doshas (pathogenic factors) like कफ but also the others that have clung to the system, is called छेदन. Example : यव क्षार (Alkaline ashes), मरिच (Piper Nigrum) and शिलाजतु (Bitumen).

11. लेखन (Lekhana):

धातून्मलान्वा देहस्य विशोष्योल्लेखयेच्च यत् ।
लेखनं तद्यथा क्षौद्रं नीरमुष्णं वचा यवाः ॥ (शा. सं. अ. IV)

Translation: That drug, which rarefies the protoplasmic contents of tissue-cells and thus gradually clears the system of its deranged constituents, is called लेखन, Attenuant. Examples : Honey, Hot water, वचा (Acorus Calamus) and इंद्रयव (The seeds of Holarrhena Antidysenterica).

12. ग्राहि (Grahi) :

दीपनं पाचनं यत्स्यादुष्णत्वाद्द्रवशोषकम् ।
ग्राहि तच्च यथा शुंठी जीरकं गजपिप्पली ॥ (शा. सं. अ. IV)

Translation: That drug which, being both an appetiser and a digestive, helps the absorption of moisture (intestinal fluid) on account of its heat-generating properties, is called

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ग्राहि (Grahi). Examples : शुंठी (Zingiber), जीरक (Cumin-seeds), गजपिप्पली) (Scindapsus Officinalis).

13. स्तंभन (Stambhana) :

रौक्ष्याच्छैत्यात्कषायत्वाल्लघुपाकाच्च यद्भवेत् ।
वातकृत्स्तंभनं तत्स्याद्यथा वत्सकटुंटुकौ ॥ (शा. सं. अ. IV)

Translation : That drug is called स्तंभन which, in addition to its having cooling, drying, and astringent properties, is also easily digestible and causes stasis and condensation in the tissue-fluids. Examples : वत्सक (Seeds of Holarrhena Anti-dysenterica). टुंटुक (Oroxylum Indicum).

Note : Difference between स्तंभन and ग्राहि :—

आग्नेयगुणभूयिष्ठं तोयांशं परिशोष्य यत् ।
संगृण्हाति मलं तत्स्याद्ग्राहि शुंठ्यादयो यथा ॥
समीरगुणभूयिष्ठं शीतत्वात् यन्नभस्वतः ।
विधाय वृद्धिं स्तभ्नाति स्तंभनं तद्यथा वटः ॥

संगृण्हाति—Inspissates. स्तभ्नाति—Arrests secretions.

विधाय वृद्धिम्—Having caused condensation.

14. रसायनम् (Rasayana) :

रसायनं च तज्ज्ञेयं यज्जराव्याधिनाशनम् ।
यथाऽमृता रुदंती च गुग्गुलुश्च हरीतकी ॥ (शा. सं. अ. IV)

Translation : The drug, which postpones oldage and prevents disease, is called रसायन. Examples : हरीतकी (Terminalia Chebula), गुडूची (Tinospora Cordifolia) गुग्गुलु (Balsamodendron Mukul and रुदंती (Cressa Cretica).

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15. वाजीकरण (Vajikaran) :

यस्माद्द्रव्याद्भवेत्स्त्रीषु हर्षो वाजीकरं च तत् ।
यथा नागबलाःद्यास्युर्बीजं च कपिकच्छुजम् ॥ (शा. सं. अ. IV)

Translation : That drug is called वाजीकर which heightens sexual desire. Examples : नागबला (Sida Spinosa) कपिकच्छु (Seeds of Mucuna Pruriens).

16. शुक्रल (Shukrala):

यस्माच्छुक्रस्य वृद्धिः स्याच्छुक्रलं च तदुच्यते ।
यथाऽश्वगन्धा मुसली शर्करा च शतावरी ॥ (शा. सं. अ. IV)

Translation : The drug, which increases seminal production, is called शुक्रल. Examples : अश्वगंधा Convolvulus Asagandha), मुसली (Curculigo Orchioides), Sugar, and शतावरी (Asparagus Racemosa). etc.

17. सूक्ष्म (Sooxma) :

देहस्य सूक्ष्मछिद्रेषु विशेद्यत्सूक्ष्ममुच्यते ।
वद्यथा सैन्धवं क्षौद्रं निंबस्तैलं रुबूद्भवम् ॥ (शा. सं. अ. IV)

Translation : The drug, which has access to all the minute parts of the body (through the circulatory and nervous channels) is called सूक्ष्म. Examples : Salt, Honey, Margosa, and Castor-oil.

18. व्यवायि (Vyavayi) :

पूर्वं व्याप्याखिलं कायं ततः पाकं च गच्छति ।
व्यवायि तद्यथा भङ्गा फेनं चाहिसमुद्भवम् ॥ शा. सं. अ. IV)

Translation : That drug is called व्यवायि which first diffuses through the whole body (through the nervous channels)

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and is then digested. Examples : विजया (Cannabis Indica), अहिफेन (Opium).

19. विकाशि (Vikashi).

सन्धिबन्धांस्तु शिथिलान्यत्करोति विकाशि तत् ।
विश्लेष्यौजश्च धातुभ्यो यथा क्रमुककोद्रवाः ॥ (शा. सं. अ. IV)

Translation : That drug which, having first dispossessed the सप्तधातुs of their ओजस् (essence), causes relaxation of the body (ligaments, joints and articulations) is called विकाशि Examples : पूगीफल (Betel-nut), कोद्रव (A type of cereal).

Definition of संधि according to Sushruta :

संधयस्तु द्विविधाश्चेष्टावंतः स्थिराश्चते ॥
अस्थ्नांतु संधयोह्येते केवलाः परिकीर्तिताः ।
पेशिस्नायुशिराणां तु संधिसंख्या न विद्यते ॥

20. विष (Visha) :

व्यवायि च विकाशि स्यात्सूक्ष्मं छेदि मदावहम् ।
आग्नेयं जीवितहरं योगवाहि स्मृतं विषम् ॥ (शा. सं अ. IV)

Translation : That drug is called विष (poison) which on account of its व्यवायि, विकाशि, सूक्ष्म, छेदन, योगवाहि (vide 24), मदकर (intoxicating), and आग्नेय (hot) properties is detrimental to life. Examples : Aconite and other poisons.

21. प्रमाथि (Pramathi) :

निजवीर्येण यद्द्रव्यं स्रोतोभ्यो दोषसंचयम् ।
निरस्यति प्रमाथि स्यात्तद्यथा मरिचं वचा ॥ (शा. सं. अ. IV)

Translation : The drug which by virtue of its inherent strength removes all pathological matter from the structures of

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the body channels, such as secretory, excretory, communicative, is called प्रमाथि. Examples : मरिच (Black Pepper), वचा (Acorus Calamus).

22. विदाहि (Vidahi) :

विदाहिद्रव्यमुद्गारमम्लं कुर्यात्तथा तृषाम् ।
हृदि दाहं च जनयेत्पाकं गच्छति तच्चिरात् ॥ (शा. सं. अ. IV)

Translation : That drug is विदाहि which, by causing eructations and acidity (in the stomach), gives rise to thirst and heart-burn and also takes greater time for absorption.

23. अभिष्यंदि (Abhishyandi) :

पैच्छल्याद्गौरवाद्द्रव्यं रुध्वा रसवहाः शिराः ।
धत्ते यद्गौरवं तत्स्यादभिष्यंदि यथा दधि ॥ (शा. सं. अ. IV)

Translation : The drug which on account of its heavy and slimy properties retards lymphatic circulation and causes retention of secretions, thus giving rise to गौरव (heaviness and fulness) is called अभिष्यंदि. Example : Curds.

24. योगवाहि (Yogavahi) :

गृण्हाति योगवाहि द्रव्यं संसर्गवस्तुजांश्च गुणान् ।
पच्यमानं यथैतन्मधुजलतैलाज्यसूतलोहादि ॥ (शा. सं. अ. IV)

Translation : योगवाहि is that vehicular medicine which, while being digested, works in harmony with (imbibes) the properties of the drug with which it is prescribed. Examples : Honey, Water, Oil, Ghee, Mercury etc.

25. ग्लपन (Glapana) : हर्षक्षयकरं अवृष्यं च ।
तर्पण (Tarpana): तृप्तिजनकम्, धातुवर्धनम् ।
आशुकारि (Ashukari) : तथाऽशुत्वात् धावति अंभसि तैलवत् ।

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तृप्तिघ्न (Triptighna) : तृप्तिः श्लेष्माविकारः, येनतृप्तमिव आत्मानं मन्यते ; तत् घ्नम् तृप्तिघ्नम् (चक्रपाणिः)

26. जीवनीय (Jeevaneeya) : जीवने संजीवने च हितम् ।

27. वेदनास्थापन (Vedanasthapana):

वेदनायां च संभूतायां तां निहत्य शरीरम्
प्रकृतौ स्थापयति इति वेदनास्थापनम् ॥

28. रक्तप्रसादन (Raktaprasadana) :

The drug which facilitates free circulation of blood by removing congestion and improving the quality of blood, is called रक्तप्रसादन. Examples : पद्मकाष्ट (Prunus pudam), हरिद्रा (Curcuma Longa), and मंजिष्ठा (Rubia Cordifolia).

B. Pharmacopoeial Agents according to Modern Medicine :

Abortifacients : These are agents which induce expulsion of foetus Example : रक्तचित्रक (Raktachitraka). Plumbago Rosea.

Alteratives : These are remedial agents which promote metabolism, alter the course of the morbid condition of blood and possess a well-marked but rather unknown action upon the general system. They also change the morbid processes of nutrition, break up newly deposited or diseased fibrin, disorganise syphilitic growth and also promote the absorption of morbid products by acting upon the sympathetic system. They are also known as resolvents' and 'discutients'. Example: Gold-salts.

Analeptics : These are agents used for restoring strength during convalescence. Examples : Nourishing foods or Tonics.

Analgesics and Anodynes : These are agents which relieve pain. The word 'analgesic' is applied to a drug which relieves actual pain, while 'an anodyne' relieves ill-defined pain and general discomfort. These act by depressing the

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sensory centre or by reducing the activity of the sensory nerves. Examples : (1) Datura Fastuosa उन्मत्त and (2) Papavarnm Somniferam अहिफेन.

Anaphrodisiacs : These are medicinal agents which lessen the sexual desire or lower the sexual function. They act by limiting the supply of blood to the generative organs or by lowering the excitability of the peripheral nerves or the nerve-centres.

Anhydrotics : These are drugs which check or diminish perspiration. They act by depressing the function of the sweat-glands, by limiting the circulation or depressing the nerve-centres.

Anthelmintics : These are medicinal agents which destroy or expel various kinds of parasites which infest the intestinal canal. They are (i) direct anthelmintics, or vermicides which destroy the worms. (ii) Indirect anthelmintics or vermifuges which expel the worms. Examples : कंपिल्लक (Mallotus Philippinensis), विडंग (Embelia Ribes).

Antilithics : These are agents which prevent the formation of renal vesical or biliary calculii. Examples : पाषाणभेद (Saxifraga Ligulata).

Antiperiodics : These are remedies which check the severity of periodic fevers such as Malaria, or which allay paroxysms like neuralgia.

Antiphlogistics : These are external applications employed to reduce inflammation, whether internal or external.

Antipyretics : and Febrifuges : These are drugs which reduce abnormal body-temperatures.

Antirheumatics: These are agents which relieve rheumatism.

Antiscorbutics : These are remedies intended for the prevention of scurvy.

Antiseptics : These are remedial agents employed to prevent or retard septic or putrefactive decomposition.

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Antisialagogues: These are agents which diminish the secretion of salivery glands.

Antispasmodics: These are agents which relieve, prevent, or control morbid spasms of voluntary or involuntary muscles n any part of the body.

Antizymotics : These are medicinal agents which arrest fermentative processes, either by destroying, or rendering inactive, the causative ferments.

Aphrodisiacs : These are drugs possessing the property of stimulating the sexual appetite and increasing the virile power.

Aperients, and Purgatives : These are the agents which increase the quantity of stools as also the number of active evacuations of the bowels. Those which act mildly are called Aperients' or' Laxatives'; those which are violent in their action are called catharties or 'Drastic purgatives', and those which produce copious watery stools are called 'Hydrogogue purgatives.

Aromatics: These are substances characterised by fragrant odour and a spicy taste and serve as stimulants to the gastro-intestinal membrane.

Astringents: These are agents which contract muscular fibres. They also lesson or control abnormal secretion of the mucous membranes, such as those of the stomach and of the intestines. Their action may be local, constitutional or remote.

Anaesthetics : These are drugs which produce temporary loss of sensation or consciousness on account of their effect upon the brain or nerve-fibres. They may be general or local.

(a) **General:** These include certain volatile substances which, when inhaled in sufficient quantities, produce complete unconsciousness. Examples: Chloroform, Ether etc.

(b) **Local :** These act upon the sensory nerves until their power of receiving or conducting sensations is lost.

Acids : These are salts of hydrogen which give acid-reaction with blue litmus paper or neutralise alkalinity. They are mineral and organic.

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Antacids : These are substances which neutralise or countract acids.

Bactericides : These are agents which destroy bacteria.

Carminatives : These are agents which relieve flatulence or pain in the bowels. They expel gas from the stomach and the intestines by increasing or regulating peristalsis. Their action on the stomach depends on their power of relaxing the muscular fibres or the gastric orifices.

Caustics or Escharotics : These are substances which when placed in contact with the living body destroy the tissues, decompose the animal-fluids and give rise to the formation of slough or eschar.

Note : Cautery : Formerly this term was applied to 'Caustics', but now it is applied to a platinum wire in connection with an electrical current.

The term 'Actual Cautery' is applied to hot iron used for the purposes of counter-irritation, removal of tissues etc.

Counter-irritants : These are agents used with the object of diminishing, counteracting, or removing some remote irritation or inflamation existing in the body. They are divided into (a) Rubefacients, (b) Pustulants, (c) Vesicants or Blisters, and (d) Caustics or Escharotics.

Demulcents : These are agents which protect mucous membranes from irritation.

Emollients : These are drugs which soften or relax the parts to which they are applied. They are oily or fatty substances intended to prevent cracking of the skin.

Dentifrices : These are powders or pastes used for the purpose of cleaning the teeth and the gums.

Deodorants : These are agents which destroy, remove or correct offensive odours. They are either volatile or non-volatile. They may or may not be antiseptics or disinfectants.

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Depilatories : These are remedies which remove the hair.

Desiccants : These are agents which when applied to open wounds or injured parts, form with the discharged matter a scab and thereby protect them from external influences.

Diaphoretics : or Sudorifics : These are remedies which produce or increase perspiration by stimulating the action of the sweat glands. Diaphoretics are milder in action while Sudorifics cause excessive perspiration.

Disinfectants : These are agents which destroy diseased germs and noxious properties of fermentation or putrefaction. All disinfectants are in a way antiseptics, but all antiseptics are not disinfectants.

Diuretics : These are agents which stimulate the flow of urine by directly stimulating the renal cells and thus increase the renal blood-supply. They also increase the quantity of urine by stimulating the heart and thus acting upon the general circulation.

Ecbolics-Oxytocics : These are drugs which cause expulsion of the contents of the uterus by contracting the uterine muscle. They may be direct or indirect.

Emetics : These are drugs which produce vomiting. They are either local, stimulating the sensory nerve-endings or the vagus in the stomach, or central, which act by stimulating the vomiting centre.

Emmenagogues : These are remedies which increase the menstrual flow when it is scanty, or restore it when it is absent.

Epispastics : These are substances which, when applied, produce blister.

Errhines: These are drugs which, when topically applied to the mucous membrane of the nose, increase the secretion. There are others which act reflexly through the Trigeminal nerve and are called ' Sternutatories. '

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Expectorants : These are the remedies which increase the bronchial secretion and help its expulsion. They can be either reflex, local, or central.

Galactagogues : These are drugs which increase the secretion of milk. Some of them are applied locally, while others are given internally.

Haemostatics and Styptics : These are drugs which arrest bleeding by contracting the blood-vessels. The former act when given internally, whilst the latter act locally.

Hypnotics and Narcotics : Hypnotics are drugs employed to induce sleep, while Narcotics are drugs which produce unconsciousness.

Haematinics : These are blood tonics. They act by increasing the amount of ' haemoglobin in the blood and thus improve its quality by enriching the blood corpuscles.

Lithantropics : These are medicines intended to dissolve the various concretions in the urinary tract.

Mydriatics : These are drugs which cause dilatation of the pupil.

Myotics : These are drugs which cause contraction of the pupil.

Parasiticides : These are the agents which destroy parasites animal as well as vegetable which infest the human body.

(Germicides are the agents which have the power to destroy germs,)

Refrigerants: These are drugs which have cooling properties or which lower the body-temperature. They are thus local or internal.

Sedatives : These sre agents which exert a soothing effect on the system by lowering the functional activity in various ways. They are classified as under : 1. General, 2. Cardiac, 3. Nervine, 4. Pulmonary, 5. Gastric, 6. Urinary, and 7. Uterine.

Sialagogues : These are drugs which increase the secretion of saliva. They are either local or general.

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Stomachics : These are drugs which increase the secretion of gastric juice ; they are both direct and indirect.

Stimulants : These are the agents which excite even briefly the normal activity or depressed function or organic action of any part of the system.

Tonics : These are the medicines which improve the tone not only of one particular system but also of all the systems jointly and severally. Their operation in all cases is general.

Vasodilators : These are the agents which produce dilatation of the peripheral vessels and thus relieve the heart, increase circulation and equalise blood-pressure ; they are therefore used to relieve internal conjection and also to relieve the embarrassed condition of the heart.

Vasoconstrictors : These are the agents which increase the contraction of the smaller vessels by acting upon their muscular fibres, raising thereby the blood-pressure and lessening circulation ; they are used to check haemorrhage and reduce inflammation.

SECTION II

METHODS OF APPLICATIONS DONE EXTERNALLY :

Besides being administered internally medicines of the Ayurvedic pharmacopoea are applied in various other ways.

I. **MOUTH:—** गंडूष, कवल and प्रतिसारण :

These are forms of gargles. Some of these are liquids, some mixtures of liquids and solids, and some exist as कल्क (Solids), चूर्ण (Powders), or अवलेह (Thick solutions) which are used as applications to the buccal mocous membrane and gums, in stomatitis. (Vide Charaka, Ch. IX त्रिपर्णीयासिद्धि).

II. **NOSE:** नस्य and धूम्रपान.

नस्य Nasya : These are medicated substances administered as snuffs. Two types of medicines chiefly used for this purpose are

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शिरोविरेचन and बृंहण ; the former consists of medicines which cause a flow of secretion from the nose and thus relieve cerebral conjestion, while the latter are medicated oils dropped into the nose with the object of cooling the head and relieving the affections of the neck and the chest. अवपीडन and प्रधमन are again two forms of शिरोविरेचन ; in the former the expressed juice of pungent drugs is instilled into the nose drop by drop, and in the latter, powders are insufflated into the nostrils. मर्श and प्रतिमर्श are again two forms of बृहणनस्य. In the former, abont a drachms of oil is recommended to be poured into each nostril from a spoon, and in the latter, two or three drops of medicated oil are directed to be snuffed up the nostrils till they reach the throat ; the medicine should be expectorated and not swallowed.

धूम्रपान Inhalation of Smoke:

Hollow tapers or pastils made of medicinal substances are used in this process. They are ignited at one end, and their smoke is inhaled by the mouth or the nose, through a metallic or wooden tube. The sticks are prepared by smearing a reed with the paste of the medicinal substances directed to be used, drying it in the shade, and then taking out the reed. The hallow tube of dried medicinal paste is laved with clarified butter before one of its end is lighted. The lighted end is inserted into the metallic or the wooden tube and the smoke is inhaled through the other end. The smoke inhaled through the nose should be exhaled through the mouth.

Indications : In affections of throat and chest inhalation of smoke thorough the mouth is recommended, while in the diseases of the head, the eyes, and the nose, fumes should be inhaled through the nose. Inhalations are also useful in cough, asthma, catarrh, pain in the neck and the head etc.

III. EYE नेत्रकर्म (Netrakarma):

Applications to the eye receive various names according to
(i) the nature of substances used,
(ii) the parts to which they are applied,

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and (iii) the manner in which they are applied. They are

(a) सेक Fomentation (b) पिंडिका A poultice.

(c) आश्चोतन Eye-drops. (d) बिडालक Paste applied to the lids.

(e) अंजन Medicines applied to the margin of the lids or to the conjunctiva either with a finger or with a metallic probe.

(f) तर्पण Applications of cooling substances such as ghee, or stupes moistened with milk.

IV. HEAD—शिरोबस्ति (Shirobasti):-Applications of oil to the head.

This is done in four different ways:

(a) The first consists in tying a piece of thick leather round the head. The leather should be at least three inches in breadth. The lower margin is attached to the skin by means of a pasty gum made from the flour of माष (Phaseolus Radiatus). Into the hollow thus made by the piece of leather wrapped round the head, medicated oils are poured and allowed to stand there for some hours. Violent forms of headache are relieved by this method.

(b) The second method, which is known as परिषेक (Parisheka), consists in keeping the head under a current of the medicinal oil.

(c) The third method, which is called पिचु (Pichu), consists in the application of a cotton-pad soaked in oil, on the head.

(d) The fourth method, which goes under the name of अभ्यंग (Abhyanga), consists in rubbing medicated oil on the head with the palm of the hand.

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V. INTESTINES— बस्तिकर्म (Bastikarma): Enemeta.

बस्तिर्द्विधाऽनुवासाख्यो निरूहश्च ततः परम् ।
यः स्नेहैर्दीयते स स्यादनुवासन नामकः ॥

— शा. सं. खं. ३

Enemeta are of two kinds, viz. (a) अनुवासन and (b) निरूह.

Emollients such as medicated ghee and oil are used in the former, while decoctions, milk and oil are used in the latter.

Indications : Vide चरक, सिद्धिस्थान, अ. १ (Charaka, Siddhishan, Ch. I.)

VI. GENITAL ORGANS— The following are different kinds of plugs made from medicated substances used for introduction into the rectum or the female genital organs.

(a) फलवर्ति These are made with the aid of butter or honey.

(b) विकेशिका, वर्ति, and पिचु These are plugs dipped into medicated substances made with oils.

विकेशिका (Vikeshika) is defined as

कल्कमधुघृताभ्यक्तवस्त्रस्य सूत्रस्य वा वर्तिः ।

—सु. सू. अ. १८ उल्हणटीका.

VII. A BODY-Generally on the SKIN: स्नेहन SNEHANA.

(a) Meaning: Application, either internal or external, of ghee, oil or other fats.

(b) Nature : As a medicine, it is heavy, cooling, flowing. unctuous, slow-acting, penetrating, soft and moist. The reverse of this is रूक्षण (Rookshana).

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Read:- गुरुशीतसरास्निग्धमन्दसूक्ष्ममृदुद्रवम् ।
औषधं स्नेहनं प्रायो, विपरीतं विरूक्षणम् ॥ १ ॥
—(वाग्भट सू. अ. १६)

(c) Use : स्नेहनं स्नेहविष्यन्दमार्दवक्लेदकारकम् ॥८॥
— च. सू. अ. २२

स्नेहन is the process which causes lubricity, secretive action, softness and moisture.

(d) Varieties : सर्पिर्मज्जा वसा तैलं स्नेहेषु प्रवरं मतम् ।
तत्रापि चोत्तमं सर्पिः संस्कारस्यानुवर्तनात् ॥२॥
—वाग्भट. सू. अ. १६

Varieties : Ghee, oily fat, marrow and oil are the chief varieties of स्नेहन. Among these ghee is the best as it is most useful in the process of the preparation of medicines.

Advantages :

युक्त्याऽवचारयेत्स्नेहं भक्ष्याद्यन्नेन बस्तिभिः ॥ १४ ॥
नस्याभ्यंजनगंडूषमूर्द्धकर्णाक्षि तर्पणैः ॥
— वाग्भट. सू. अ. १६

स्नेहन should be used systematically in dietary, enemeta, snuffs, massages, gargles, and in the cooling medications of the head, ear and eye.

(f) Indications :

स्वेद्याः शोधयितव्याश्च रूक्षा वाताविकारिणः ।
व्यायामद्यस्त्रीनित्याः स्नेह्याः स्युर्ये च चिन्तकाः ॥ ५१ ॥
-- च. सू. अ. १३.

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Only such persons are to be given स्नेहन who are to be operated with स्वेदन, वमन, and विरेचन, who have a thin and wiry constitution, who have nervous diseases, who exert too much, who indulge in wine and woman, and also to those who worry themselves too much.

(g) Time to do स्नेहन:

स्नेहमग्रे प्रयुंजीत ततः स्वेदमनन्तरम्
स्नेहस्वेदोपपन्नस्य संशोधनमथेतरत् ॥ ९९ ॥
— च. सू. अ. १३.

स्नेहन is to be adopted first (in पंचकर्मचिकित्सा) then स्वेदन, and after both of these are properly done, संशोधन (वमन + विरेचन). This is because it has been assumed by the Ayurvedists that eliminating processes like वमन, विरेचन, बस्ति etc. do not act properly unless स्नेहन and स्वेदन are first done. And it is exactly for this reason स्नेहन, according to the Ayurvedic system, forms the first and preparatory step for the performance of पंचकर्मचिकित्सा. In substantiation of this चरक gives the following reasons :

स्नेहोऽनिलं हंति मृदुं करोति देहं मलानां विनिहंति संगम् ॥६॥
स्निग्धस्य सूक्ष्मेष्वयनेषु लीनं स्वेदस्तु दोषं नयति द्रवत्वम् ॥ ६ ॥
— च. सिद्धि. अ. १

Translation: स्नेहन cures nervous diseases, brings softness to the body, and removes stacis (accumulation) of theexcretions. स्वेदन rarefies (attenuates) the toxins situated in the finer structures and liquifies them (in order to facilitate their easy elimination).

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In this connection वाग्भट observes:

स्नेहक्लिन्नाः कोष्ठगा धातुगा वा । स्रोतोलीना ये च शाखास्थिसंस्थाः ।
दोषाःस्वेदैस्ते द्रवीकृत्य कोष्ठं । नीताः सम्यक् शुद्धिभिर्निर्ह्रियन्ते ॥२९½॥
— वाग्भट सू. अ. १७

Translation: The toxins, which are embedded in the alimentary canal, (सप्तधातु) the Seven Dhatus, the finer excretory ducts and also in the bones and in the extremities, become first dissolved by स्नेह, are further attenuated by स्वेद and are then directed towards the intestines to be ultimately eliminated out of the system.

Apart from the physiological, vital and selective action of the epithelial lining of the alimentary canal or mucous membranes of other organs, the physical process of filtration, osmosis, and imbibition have to be carried through satisfactorily. This is accomplished by keeping the lining membrane in a healthy condition. The lining membrane consists of a structure of fine cells whose function is to secrete as well as to excrete certain body-fluids. The cell, which is in fact the ultimate element of the tissues, is responsible for all types of assimilation. Its function depends upon the surrounding media which may or may not be supporting. When the extracellular medium is wanting in the elements which are indispensable for the purpose of elimination, the cell ceases to function and thus degenerates. The process of further regeneration and multiplication of cells, therefore, cease with the result that धातु उपचय (reproduction of cells) is hampered.

Charaka explains these phenomena sufficiently and clearly in the following words :

यावन्तः पुरुषे मूर्तिमन्तो भावविशेषास्तावन्त एवास्मिन् स्रोतसां प्रकारविशेषाः, सर्वभावा हि पुरुषे नान्तरेण स्रोतांस्यभिनिर्वर्तन्ते क्षयं वाऽप्यधिगच्छन्ति ; स्रोतांसि खलु परिणाममापद्यमानानां धातूनामभिवाहीनि

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भवन्त्ययनार्थे ॥२॥ अपि चैके महर्षयः स्रोतसामेव समुदायं पुरुषमिच्छन्ति, सर्वगतत्वात्सर्वसरत्वाच्च दोषप्रकोपणप्रशमनानां; नत्वेतदेवं, यस्य च हि स्रोतांसि यच्च वहन्ति यच्चावहन्ति यत्र चावस्थितानि, सर्वं तदन्यत्तेभ्यः ॥ ३ ॥

— च. वि. अ. ५

Translation : There are as many varieties of cells in this body as there are groups of elementary tissues. Without the medium of cells neither activity nor inactivity in the body can take place. These cells are again the sources out of which the various dhatus are formed. Many sages are of opinion that पुरुष (Purusha) is the embodiment of these cells, because the latter are present in every tissue, travel in all directions and have the power to provoke as well as pacify the दोषs. But the sage Atreya says, 'It is not so. It is the पुरुष to whom the body, which is a collection of cells, belongs. The thing brought (absorbed) or (Liberated) carried by these स्रोतांसि or that which is the habitation of these is naturally an object different from them.'

So, for the normal function of वात, पित्त and कफ (the fundamental supports of the body) these cells are absolutely necessary. They are distributed all over the body. They are maintained by आहार रस. The chief of the स्रोतांसि are :

(a) प्राणवह स्रोतस् (b) उदकवह स्रोतस् (c) अन्नवह स्रोतस्
(d) रसवह स्रोतस् (e) रक्तवह स्रोतस् (f) मांसवह स्रोतस्
(g) मेदोवह स्रोतस् (h) अस्थिवह स्रोतस् (i) मज्जावह स्रोतस्
(j) शुक्रवह स्रोतस् (k) पूरीषवह स्रोतस् (l) मूत्रवह स्रोतस्
(m) स्वेदवह स्रोतस्

Regarding the importance of the extra-cellular medii which are also necessary for the proper functioning of these cells, चरक (Charaka) says :

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आहारपरिणामकरास्त्विमे भावा भवन्ति; तद्यथा
उष्मा वायुः क्लेदः स्नेहः कालः समयोगश्चेति ॥ १३ ॥

— शारीर. अ. ६

In the above quotation उष्मा means जाठराग्नि– the gronp of glands which secrete Hydrochloric acid, Pepsin etc. क्लेद means बोधक and क्लेदक कफs signifying the secretion of salivary and gastric glands. These factors along with a proper temperature and an adequate nerve-force are, therefore, necessary for the functions of secretion and excretion, which indeed are the main parts of digestion. Now, as ingestion of food is naturally accompanied with the production of waste-matter, the outlets through which this waste matter is discharged are required to be clean. The cells referred to above, which form the sole back-ground on which all the phenomena depend, are required to be kept free from all interruption and disturbance. The पंचकर्मविधि which consists of वमन, विरेचन, निरूह, अनुवासन, and नस्य, if properly carried out, accomplishes the purpose of cleaning the whole system. The extent of action covered by these processes can be judged from the details given herebelow :

(a) वमन	acts on	1. Salivary glands. 2. Upper respiratory passage. 3. Lungs. 4. Oesophagus, stomach, and its follicles.
(b) विरेचन	,, ,,	1. Liver. 2. Intestines and their Lacteals and Villi. 3. Pancreas.
(c) बस्ति	,, ,,	1. Colon, rectum, anus. 2. Bladder, Urethra. 3. Generative organs–both male & female.

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(d) नस्य acts on 1. Nose, frontal sinuses, and olfactory nerves.
2. Throat.
3. Brain, through the cerebro-spinal nerves.

Hence it follows that the healthy discharge of their functions on the part of the स्रोतांसि, is as essential for the normal performance of the functions of absorption, as is the proper discharge of their duties by the organs which perform the ultimate assimilative functions. Hence the propriety of performing स्नेहन and स्वेदन before पंचकर्म is started.

The Methods of External Applications of d ugs are well treated in Sharangadhar chs. V, VI, VII, VIII, IX, X, XI, XIII, and also in वाग्भट, सूत्रस्थान, Chs. 16-24.

(i) अभ्यंग:

अभ्यंग, consists in rubbing the body with diverse kinds of medicated oils. The choice of the drugs to be used depends upon the indications for the application of these oils.

(ii) लेपन—Application of pigments, pastes, or plasters. They are of three kinds : (a) प्रलेप, (b) प्रदेह, and (c) आलेप.

(a) प्रलेप : प्रलेपः शीतस्तनुरविशोषी विशोषीवा ॥ —सु. सू अ. १८
Article V.

Notes: विशोषी—drying i. e. which checks secretions by contracting the vessels and condensing the tissues.
अविशोषी (स्निग्ध)—means which does not completely dry but which maintains suppleness of the skin.

(b प्रदेह : प्रदेहस्तु उष्णः शीतो वा (बहलो) बहुरविशोषी च ॥

Translation प्रदेह may be hot or cold, and thick but moist (स्निग्ध). A hot प्रदेह is used in वातकफ दोष, whereas a

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cold one is used in पित्त रक्त दोष. Its properties are described by SUSHRUTA in the following line. वातश्लेष्म प्रशमनः, संधानः, शोधनः, रोपणः, शोफ वेदनापहः ।

(c) आलेप : आलेपो मध्यमोऽत्र It is described as रक्तपित्त प्रसादकृत् i.e. which abates heat, removes conjestion, and thus adjusts cutaneous circulation. It is thus midway between प्रलेप and प्रदेह. आलेप is not the same as कल्क, for the former is described as possessing the following properties :

1. आस्रावसंनिरोधः —Checking secretions or exudations.
2. मृदुता —Maintaining softness.
3. पूतिमांसावकर्षणम् —Separating decomposed or dead parts from the healthy ones.
4. अनंतर्दोषता —Eliminating all internal toxins.
5. व्रणशुद्धि —Purification of the wound by removing the septic matter.

It also includes the healing of ulcers.—सु.सू.अ.१८ Article VI

Regarding the application of the different varieties of लेपनs SUSHRUTA gives the following examples :

Kind of लेपन.	Indications.	Remedies.
प्रलेप	वातशोफे	मातुलंग, अग्निमंथ, भद्रदारु
	पित्तशोथे	दूर्वा, नलमूल, मधुक, चंदन,
	श्लेष्मशोथे	अजगंधा, अश्वगंधा, कालासरला
आलेप	वाते	स्निग्धाम्ल, लवण
	पित्ते	पयोयुत
	कफे	क्षारमूत्राढ्यः
प्रदेह	वातश्लेष्मयोः	तिल, सर्षप, अतसी.

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(iii). धूपन —Fumigation: Fumigations are employed for ulcers and skin-diseases. Sticks or pastilles are made in the same way as in the case of 'Inhalation'. A small hole is made in the lid and a tube is inserted into it; the other end is directed towards the part that is to be fumigated. The smoke of the burning stick issuing out of the tube spreads over the affected part. Sometimes medicinal fragrant substances are burnt in the sick-room for removing the disagreeable smell.

VII (B) स्वेदन (Swedana):

i. Definition:

उष्णं तीक्ष्णं सरं स्निग्धं रूक्षं सूक्ष्मं द्रवं स्थिरम्।
द्रव्यं गुरु च यत् प्रायस्तद्धि स्वेदनमुच्यते ॥१४॥

—च. सू. अ. २२

Translation: स्वेदनद्रव्य is an object which is hot, active, causing movement, viscid, drying, penetrating, moist, and steady, but generally heavy.

ii. Uses:

स्तंभगौरवशीतघ्नं स्वेदनं स्वेदकारकम् ॥९॥

—च. सू. अ. २२

Translation: स्वेदन removes rigidity, heaviness and cold, and creates perspiration.

iii. Varieties:

चतुर्विधः स्वेदः; तद्यथा—तापस्वेद, ऊष्मस्वेद,
उपनाहस्वेदो, द्रवस्वेद इति। अत्र सर्वस्वेदविकल्पावरोधः ॥३॥

—सु. चि. अ ३२

Translation: It is of four varieties viz. 1. तापस्वेद 2. ऊष्मस्वेद, 3 उपनाहस्वेद, and 4. द्रवस्वेद.

These include all other methods of inducing perspiration.

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iv. Advantages:

अग्नेर्दीप्तिं मार्दवं त्वक्प्रसादं। भक्तश्रद्धां स्रोतसां निर्मलत्वम्।
कुर्यात् स्वेदो हन्ति निद्रां सतन्द्रां। सन्धीन् स्तब्धांश्चेष्टयेदाशुयुक्तः ॥२०

—सु. चि. अ. ३२

शुष्काण्यपि हि काष्ठानि स्नेहस्वेदोपपादनैः
नमयन्ति यथान्यायं किं पुनर्जीवतो नरान् ॥४॥

—च. सू. अ. १४

Translation : स्वेदन, when properly applied, produces the following beneficial effects.

(1) Appetite is kindled.
(2) The skin gets soft, and its complexion becomes lustrous.
(3) It creates relish for food.
(4) The tissues get rid of all deleterious matter.
(5) The patient gets (sound) sleep without any disturbance In other words, sleep, free from all languor, is ensured.

(6) The stiffness of the joints disappears and they become free and movable. This is quite natural, for if dry hard wood can be made soft by means of स्नेहन and स्वेदन, then what of living men!

V. Indications :

(1) एषां नस्यं विधातव्यं बस्तिश्चैव हि देहिनाम्।
शोधनीयाश्च ये केचित् पूर्वं स्वेद्यास्तु ते मताः ॥१६॥

—सु. चि. अ. ३२.

Translation : स्वेदन should be a preliminary process in the case of persons who are to be operated with नस्य, वमन, विरेचन, and बस्ति.

(2) तत्र तापोष्मस्वेदौ विशेषतः श्लेष्मघ्नौ ॥ १४॥
उपनाहस्वेदो वातघ्नः, अन्यतरस्मिन् पित्तसंसृष्टे द्रवस्वेद इति ॥१४॥

—सु. चि. अ. ३२

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वातश्लेष्माणि वाते वा कफे वा स्वेद इष्यते ।
स्निग्धरूक्षस्तथा स्निग्धो रूक्षश्चाप्युपकल्पितः ॥७॥

— च. सू. अ. १४

Translation : Out of the four varieties of स्वेदन mentioned above, the first two are used in relation to कफदोष, the third, in relation to वातदोष and the fourth, in relation to पित्तदोष

According to चरक, स्वेदन (fomentation) is indicated in diseases caused by वातकफ, वात and कफ doshas. In वातकफ affections it should be moist but hot, in वात affections moist, and in कफ affections, dry.

V.. Precautions :

नान्यभ्यक्ते नापि चास्निग्धदेहेस्वेदो
योज्यः स्वेदविद्भिः कथंचित् ॥१९॥

— सु. चि. अ. ३२.

Translation : No form of स्वेदन is to be undertaken unless the patient is massaged with oil, or he is given स्नेहन in some form.

VII. How स्वेदन acts :

स्वेदन constitutes the method of application of heat–direct as well as indirect. Baths (local or general), poulticcs, fomentations etc. form the direct methods of application of heat, whereas, arrangements of special rooms with temperature regulated according to the affections of the patients, form the indirect method. CHARAKA mentions thirteen ways in which application of heat can be made. These indeed are methods in which shower baths, hot-packs, hot-air-chamber-baths, and also the regulation of room-temperature by means of pipes are all included.

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Whatever the form of application, the skin is the medium through which heat is conducted along the blood to the cutaneous, subcutaneous and the deeper tissues. In Ayurvedic medicine adventage is taken not only of the immediate but also of the remote effects of the application of heat on the tissues and the organs. The indications for स्वेदन show that it is utilised in respiratory, gastro-intestinal and nervous disorders. The exchange of अप्धातु (watery content of blood) between the स्थानs of वात, पित्त and कफ, has long been recognised by the Ayurvedists and it is upon this most important principle in the body-economy that the indication of स्वेदन as a preparatory step to पंचकर्म चिकित्सा is suggested. The skin, in fact, is a very vascular organ and is liable to variations in its blood-supply, such as in the case of anaemia and hyperæmia, and many other maladies which can be traced to malnutrition. The secreting action is influenced by the general condition of the vascular and nervous systems (भ्राजकपित्त and व्यान वायु). It must be remembered again that the skin is an important heat-losing area just as the gastro intestinal tract is a heat-producing area. The chief function of the sweat glands is to provide a large volume of water that will bathe the skin and thus enable the heat to be lost by evaporation. In this connection CHARAK writes स्वेदवहानां स्रोतसां मेदो मूलं रोमकूपाश्च, ॥ १२ ॥

—च. वि अ ५

If the vessels of the skin are contracted, the amount of heat lost will be less than that if they are dilated. In all pathological conditions, स्वेदन by dilating the cutaneous vessels brings about such changes in the visceral circulation as affect the concentration of toxins. The toxins, whether formed by perverted metabolism or absorbed from the bowels, first irritate and then contract the muscular coats of smaller vessels, particularly those in the splanchnic area, where they are in the highest degree of concentration. When, in treatment, स्वेदन is

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followed by वमन and विरेचन, the toxins from the gastro-intestinal tract are led away by the blood-current out of the system and then are eliminated. There is a general play-backwards and forwards-among the excretory organs, in the elimination of water from the system and this is noticed in the case of lungs, kidneys, and the bowels. In health, there is a limit to this transference of blood-water from organ to organ and this is what is called 'Compensatory action' (धातुसाम्यक्रिया). When, in disease, this limit is transgressed, congestion and oedema take place. Oedema is caused by venous fullness with pressure on the venous radicles. It occurs when the circulation is defective due either to cardiac failure or to the disease of the kidneys.

The PURPOSE of स्वेदन in पंचकर्मचिकित्सा is but limited. It cannot be of use in all sorts of accumulations, e.g. those in cardiac or hepatic dropsy or renal oedema where constitutional treatment is essential. In such cases it can be used as supplementary to the main lines of treatment. The following stanzas given by Wagbhat in अष्टांगहृदय correctly show the indications for स्वेदन.

श्वासकासप्रतिश्यायहिध्माध्मानविबन्धिषु ।
स्वरभेदाऽनिलव्याधिश्लेष्मामस्तम्भगौरवे ॥२५॥
अङ्गमर्दकटीपार्श्वपृष्ठकुक्षिहनुग्रहे ॥
महत्त्वे मुष्कयोः खल्यामायामे वातकंटके ॥२६॥
मूत्रकृच्छ्रार्बुदग्रन्थिशुक्राघाताढ्यमारुते ।
स्वेदं यथायथं कुर्यात्तदौषधविभागतः ॥२७॥

—अष्टांग हृ. सू. अ. १७

Thus it is useful in :

1. Catarrhal conditions of the upper respiratory tract and also of the pulmonary and bronchial areas.
2. Meteorism, Intestinal stasis.

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3. Nervous diseases such as pains, neurosis, neuralgias, tremors, paralysis etc.

4. Rheumatic and gouty affections.

5. Retardation of lymph (आम) and mucous secretion, resulting in swelling.

6. Malaise and general indisposition due to feverish conditions.

7. Obstruction in the urinary passages.

Now, the four varieties of स्वेदन mentioned on page 278 are described herebelow :

1. तापस्वेद—This consists in the application of dry heat by means of heated plates, bricks, sand, cloth, or the palm of the hand. If the patient is confined to bed, metal pots filled with cinders of खदिर (Khadir) wood are used for fomentation.

2. उष्मस्वेद—Application of hot steam.

This is effected in various ways. They are described below:

(a) The part to be heated is covered with wet cloth. Bricks, stones, or iron plates are first made hot and sprinkled over with कांजिक or some medicinal decoction and are then applied to the affected part.

(b) An earthen pot with a small opening in its side is filled with hot water or some decoction. Then a tube is adjusted to the hole and the steam thus coming out through this hole is then directed to the affected part.

(c) First the ground is heated by burning catechu-wood over it. Then the fire is removed and the spot is sprinkled over with some decoction and thereafter covered with castor-leaves. Then the patient is made to lie on this bed of leaves and cover himself with a blanket.

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or (d) The ground should, first, be covered with different kinds of pulses, well boiled. Then a mat should be spread over these and the patient should then be made to sleep on the bed thus made.

3. उपनाहस्वेद— The application of heat by hot medicated substances in different forms—pastes, plasters, poultices etc. Poultices are made of rice, or wheat-flour, or of वेसवार, a kind of medicinal spice. Fomentation is also made with cloth wrung out of hot water or decoctions.

4. द्रवस्वेद—This means a hot bath in a tub containing warm water or decoctions. Milk, broth, oil, conjee, meat-juice etc. are used for these baths.

The means by which application of heat is made in general practice are summarised in the following lines from Bhishak-Darpana :

तप्तैः सैकत पाणि कांस्य वसनैः स्वेदोऽथवांगारकैः ।
लेपाद्वातहरैः सहाऽम्ललवणस्नेहैः सुखोष्णैस्तथा ॥
एवं तप्तपयोंबुवातशमनक्वाथादिसेकादिभिः ।
तप्तैस्तोयनिषेचनोद्भवबृहद्वाष्पैः शिलाद्यैः क्रमात् ॥
—भिषक्-दर्पण.

CHARAKA mentions ten other ways of bringing about स्वेदन without the application of heat. They are called अनाग्नेय and are described in the following lines :

व्यायाम उष्णसदनं गुरुप्रावरणं क्षुधा ।
बहुपानं भयक्रोधावुपनाहाहवातपाः ॥६३॥
स्वेदयंति दशैतानि नरमग्निगुणादृते ॥
—च. सू. अ. १४

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Translation: स्वेदन is brought about by

1. व्यायाम exercise, 2. उष्मसदन hot chambers,
3. गुरुप्रावरण thick coverings, 4. क्षुधा hunger,
5. बहुपान excessive drinking, 6. भय fear,
7. क्रोध excitement due to anger, 8. उपनाह poultice,
9. आतप the sunshine, 10. आहव fighting.

VII. C **BATHS** : The immersion of the whole or a part of the body in some liquid is called 'a bath'. It is said to be general when the whole body is brought under its influence, and local when a part only. Strictly speaking, only medicated baths come under स्वेदन therapy. However, a description of the different kinds of medicated as well as non-medicated baths is given below for information.

Scale of Temperature of Baths :

Kind of Bath.	Temperature in Degrees F.
1. Cold bath	45 to 65.
2. Cool ,, ...	65 ,, 75.
3. Tepid ,, ...	85 ,, 95.
4. Warm ,, ...	95 ,, 100.
5. Very Hot bath	110 ,, 120.

(6) **Vapour Baths:**

Kind of Bath.	Temperature in Degrees F.
1. Warm	100 to 150.
2. Hot	115 ,, 140.

A vapour bath may be improvised by placing in bed a few strong bottles filled with nearly boiling water, tightly corked down, and wrapped in pieces of flannel wrung out of hot water. The patient should be well covered and the bottles should be placed all round him.

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(7) **Contineous Baths:** The patient, having his head covered with a piece of cold cloth, lies fully immersed in water at 95 to 100 degrees F. It is useful in severe skin-eruptions like pemphigus, and nerve-lesions such as paraplegia, locomotor-ataxy, hemiplegia, contractures, sciatica, and rheumatism-muscular as well as articular.

(8) **Turkish Bath:** The patient after drinking water freely enters a room with a temperature at 110° to 130° F. When perspiring freely he enters another room at 150° to 200° F. and stays there for a few minutes, and during this time he is rubbed vigorously with bare hands. A cold douche at 60°F. is then given and this is followed by a cold sponge at 60°F. He is then allowed to lie down until the skin is dry, and the pulse is normal. Finally he is rubbed with alcohol and allowed to rest.

(9) **Medicated Baths:** 1. **Sea bath:** On account of the presence of the various saline ingredients in sea-water, sea-bathing is especially invigorating and stimulating to the skin. The temperature being more or less uniform sea-bathing is recommended for persons of weak constitution as it can be easily borne by them.

2. **Salt bath:** This is prepared by adding sodium chloride or sea-salt, 4 to 8 Ozs. to every gallon of water.

3. **Alkaline Bath:** This is prepared by adding sodium carbonate ¼ Oz. to every gallon of water.

4. **Acid-Boric Bath:** This is prepared by adding boric acid 2 Ozs. to every gallon of hot water.

5. **Sulphur Bath:** This is prepared by adding 1/4 oz. Potassium Sulphurata to every gallon of water used.

6. **Mustard Bath:** In this kind of bath, mustard 1/2 to 1 Oz. should be added to every gallon of water which should be as hot as possible.

7. **Bran Bath:** Four pounds of wheaten bran are boiled in one gallon of water and strained. This liquid is then added to water which should be sufficient for a bath. This bath removes the irritation of the skin.

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8. **Neem Bath:** This is prepared by adding the decoction of the leaves of Melia Azadirachta to the ordinary bath. It may be general or local. In India it is largely employed in the various skin diseases.

Some remedies useful in surgical diseases:

1. दारणं: दारणं, विदारणं पक्वशोथस्य । सु. सू. अ. ३७

Translation: A medicine which helps the bursting of an abscess.

2. पीडनम्: मर्मादि समीप सूक्ष्मव्रणमुख पीडनम् ।

Explanation: व्रणमुखं वहिःकृत्य लेपयेत् । लिप्त्वा च शोषयेत् । शुष्कं सत् पीडनं भवति ॥ सु. उल्हण टीका

Note: To help the elimination of pus which is just formed and deep-seated, by means of लेपन, either warmed leaves of शाल्मली (Bombax Malabaricum), वट (Ficus Bengalensis) etc. are used, or hot poultices made of wheat-flour are used.

3. रोपणम्—संरोपणम्: Employed to stimulate the appearance of granulations.

4. शोधनम्: Purification by means of antiseptic drugs; removal of pathogenic products.

5. पाचनम् (शोथस्य): To induce the ripening of inflammatory swellings by means of poultices (उपनाह, स्वेदन).

6. उत्सादन=मांसवर्धनम् प्रलेपयोगात्; निम्न व्रणस्य उन्नती करणम् Inducing granulations. —सु. सू. अ. ३७

7. अवसादन=मांस स्फोटनम्; उन्नत व्रणस्य निम्नत्वकरणम् Removal of exuberant granulations. —सु. सू. अ. ३७

8. विम्लापन=अंगुल्यादि मर्दनेन शोफ विलयनम्

To reduce swelling by promoting absorption by manipulation. सु. सू. अ. ३७

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9. अवसेचन=जलौकादिभिः रक्त विस्रावणम्

Depletion of blood with the help of leeches. —सु. सू. अ. १७

10. संधान=घात विशेषात् द्विधाभूतस्य अवयवस्य ऐक्यभावः

11. निर्वापण=पक्काभिमुखिनः व्रणशोथस्य दाहतोद प्रशमनम्

12. क्षारकर्म (Kshara-karma) use of caustics.

क्षारकर्म means the use of caustics. There are three varieties of caustics. मृदु, मध्यम, and तीक्ष्ण names are used in accordance with their potency. There are two varieties:—(1) one which is used for internal administration, named पानीय and (2) the other which is used for external application named प्रतिसारणीय.

(1) The पानीयक्षारs are used in toxic conditions, indigestion, constipation, flatulence, gravel, internal inflammatory conditions, worms, poisons, haemorrhoids etc.

(2) The प्रतिसारणीयक्षारs are used in skin diseases, fistulae, tumours, moles. piles, chronic and callous ulcers, sinuses, abscesses, diseases of the throat and gums and such other conditions where cauterisation is indicated or intended.

Preparation of क्षारs

मृदुक्षारः The roots, stems and leaves of the chosen plants are cut into pieces and burnt in a pit along with lime-stones. The ashes only are then collected, mixed with water six times their weight and kept for some time. The mixture is then strained twenty-one times and the clear solution thus obtained is boiled. The burnt lime stones, separated from the mixture and kept apart, are now to be made hot again and immersed in the boiling solution. The solution is strained again and boiled till it becomes red, pungent, transparent and soapy to the feel. It is then cooled and stored in a china-clay-pot.

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मध्यमक्षार :—In this preparation the plants are to be burnt as before either separately or together in a heap. Sushruta advises that मुष्कक alone is to be burnt separately and the others in one heap. Two parts of the ashes of मुष्कक and one part of the ashes of other plants are to be mixed together and kept in a vessel filled with water, sixteen times the weight of the ashes. The mixture is then kept for a few hours and strained twenty-one times and then boiled on slow fire as before. While the solution is being boiled the burnt lime-stones are made red-hot and immersed in it. The lime stones are then to be separated by straining the solution, powdered and again added to the solution. शुक्तिभस्म and शंखभस्म are also added to this. The whole is then boiled till the fluid attains a consistency which is neither liquid nor solid, becomes viscous and thick. This is then cooled and stored in an earthen or glass vessel.

तीक्ष्णक्षारs The process adopted here is the same as before but the ashes of a few more plants are to be added to the solution prepared for मध्यमक्षार. The mixture is then boiled in an iron vessel till the solution gets thick. The additional plants used in this preparation are दंती, द्रवंती, चित्रक, लांगली, पूतीक, तालपत्री, कनकक्षीरी, हिंगु, वचा, अतिविषा etc.

The plants that are commonly used for preparing क्षारs as mentioned by Wagbhata are as follows:— कालमुष्कक, पाटला, कुटज, पलाश, अश्वकर्ण, पारिभद्र, बिभीतक, आरग्वध, लोध्र, अर्क, स्नुही, अपामार्ग, करंज, वासक, कदली, चित्रक, पूतीक, देवदारु, आस्फोता, करवीर, सप्तपर्ण, अग्निमंथ, गुंजा, कोशातकी, etc.

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CHAPTER VI

MODES OF ADMINISTRATION OF DRUGS.

SECTION I

Routes of Administration: The following are the various routes through which drugs can be introduced into the system. It should, however, be remembered that as the various surfaces of the body possess different degrees of vascularity as well as different powers of absorption, the rapidity of the entrance of a drug into the circulation as well as its activity varies considerably with the route adopted for its administration.

(a) The unbroken skin, e.g. स्नेहन, स्वेदन, लेप, अभ्यंग etc.

(b) The Mucous Membrane, e.g. नस्य, गंडूष, बस्ति, आश्चोतन पिचु etc.

(c) Diseased surfaces, e.g. 1. Applications प्रलेप, प्रदेह, आलेप, अभ्यंग etc.

2. Lotions: कषाय for व्रणधावन, परिषेक etc.

3. Dusting powders: रोपण and शोधनचूर्ण.

4. Collirium : अंजन

5. Plugs. वर्ति, विकेशिका, पिचु

6. Poultices : उत्कारिका, पिंडिका.

(d) (Inhalations through) The, nose, larynx or the lungs. } e. g. धूम्रपान.

(e) The Alimentary canal :

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1. **The Mouth :** Drugs are administered by this route either for their local action through रस, or for absorption by the alimentary tract through वीर्य, विपाक and प्रभाव of the drugs. Sometimes drugs produce a systemic effect when they are absorbed through the mucous membrane of the mouth e.g. मात्राs like सूतशेखर and हेमगर्भ.

Some drugs are made to act locally by being held in the mouth till they are completely dissolved.

2. **The Stomach and the Intestines :** These are the routes most frequently employed for the administration of medicinal drugs which, passing through the walls of the gastro-intestinal blood-vessels and the lacteals, enter the blood and are thus admitted into the general circulation. Thus, crystalloids in solution pass more readily through the walls of the gastro-intestinal blood-vessels than colloidal substances like fat, albumin, gum, gelatine etc., which require to be emulsified or predigested before being absorbed.

Drugs like वमनद्रव्यs, क्षारs and अम्लद्रव्यs are sometimes used for their local action on the stomach. Others like purgatives, exert their influence mainly on the intestines and (slightly) hardly on the stomach. But the greatest use of the drugs administered by the upper gastro-intestinal route is for their systemic effect after absorption. Now, absorption is influenced by (i) the solubility of the drug and (ii) the form in which it is administered. Thus गुटिकाs take longer time for absorption than क्वाथs.

Generally drugs act more efficiently on an empty stomach than on a full one. The majority of the drugs are introduced into the stomach by the mouth, but in exceptional cases nasal feeding is resorted to.

3. **The Rectum :** Drugs are sometimes administered by this route for their local action on the rectum and also for their

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systemic effect, as in the case of the diseases of the nervous system (वातव्याधि). In modern medicine this route is availed of mainly to wash off the bowels and in some cases to introduce nutrients like glucose solution, saline solution etc., to maintain the strength of the patient or to counteract toxaemia. In some instances, emollients, astringents and anthelmintic drugs are used. In Ayurved, on the otherhand, बस्तिs are used to serve not only as nutrients or cleansing agents but also as therapeutical remedies for वात, पित्त and कफ diseases. This is a vast subject and it is not the purpose of this book to enter into details. CHARAKA has devoted one special section to the treatment of this subject and has given reasons to establish its importance. A few of them are given here below to give an idea of the real importance of this subject ; for the subject has been unfortunately neglected by the profession and therefore it deserves to be studied and brought into practice in consideration of the vast field it covers. CHARAKA says :

बस्तिर्वयःस्थापयिता सुखायुर्बलाग्निमेधास्वरवर्णकृच्च ।
सर्वार्थकारी शिशुवृद्धयूनां निरत्ययः सर्वगदापहश्च ॥२६॥
विट्श्लेष्ममूत्रानिलपित्तकर्षी दार्ढ्यावहः शुक्रबलप्रदश्च ।
—च. सिद्धि. स्था. अ. १

Translation: बस्ति increases the duration of life, makes it happy, gives strength, improves memory, voice and digestive power, and brightens the complexion. It produces a uniform effect on children adults and the old. It is not harmful but is useful in many diseases. It removes the noxious matter from the tissues, reduces the वात, पित्त and कफ doshas and rectifies the processes of excretion (मल and मूत्र). Consequently it affords stability and thus indirectly strengthens the reproductive capacity in man by improving his virile power.

शाखागताः कोष्ठगताश्च रोगा मर्मोर्ध्वसर्वावयवांगजाश्च ।
ये सन्ति तेषां न तु कश्चिदन्यो वायोः परं जन्मनि हेतुरस्ति ॥३७॥

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विण्मूत्रपित्तादिमलाशयानां विक्षेपसंघातकरः स यस्मात् ।
तस्यातिवृद्धस्य शमाय नान्यद्वस्तेर्विना भेषजमस्ति किंचित् ॥३८॥
तस्माच्चिकित्सार्धमिति ब्रुवन्ति सर्वां चिकित्सामपि वस्तिमेके ।

—च. सिद्धि. स्था. अ. १

Translation: There is no causative factor other than वायु which can account for the affections of the extremities, stomach, intestines, head or any other organ in the body. As वायु eliminates all toxins in the digestive tract and improves the circulation by removing all conjestion, it is necessary to see that it is not deranged; and in order to preserve it in a normal condition, there is no other remedy except वस्ति. वस्ति, therefore, occupies half the field of treatment. Some physicians even say that it constitutes the whole Treatment. For details the reader is referred to Charaka, Siddhisthana.

SECTION II

Dosage and the Modifying Circumstances that influence the regulation of Dose :

(a) General remarks regarding Dosage.

1. स्थितिर्नास्त्येव मात्रायाः कालमग्निं वयो बलम् ।
प्रकृतिं देशदोषौ च दृष्ट्वा मात्रां प्रयोजयेत् ॥

—नि. र. सामान्य परिभाषा.

2. अल्पमात्रं महावेगं बहुदोषहरं सुखम् ॥
लघुपाकं सुखास्वादं प्रीणनं व्याधिनाशनम् ॥१४॥ १२
अविकाराविपन्नं च नातिग्लानिकरं च यत् ।
गन्धवर्णरसोपेतं विद्यान्मात्रावदौषधम् ॥१५॥ १३

—च. सं. सिद्धि. अ. ६

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3. मात्राकालक्रियाभूमिदेहदोषगुणांतरम् ।
प्राप्य तत्तद्धि दृश्यंते ते ते भावास्तथा तथा ॥४५॥
तस्मात्स्वभावो निर्दिष्टस्तथा मात्रादिराश्रयः ।
तदपेक्ष्योभयं कर्म प्रयोज्यं सिद्धिमिच्छता ॥४६॥

—च. सं. सू. अ. २५

General remarks: No definite instructions regarding the dosage of drugs are given in the Ayurvedic books. They have given, here and there, only general instructions regarding dosage and the characters of medicines and diet to be prescribed. They are :

1. There is no fixed rule for determining dosage. It should be determined after taking into consideration the age, strength, digestive power, constitution, derangement, habitat of the patient, and the season in which the medicine is given.

2. The medicine should have the following properties : It should (a) be palatable and pleasing, (b) remove the majority of the doshas in a beneficial way, (c) be easily digestible, (d) remove painful symptoms, (e) not create any other disease or complications, (f) not cause weakness or exhaustion, (g) have a sweet smell and taste, and also pleasing appearance. Such a medicine should be reckoned as appropriate.

3. It has been observed that some factors like the dose and the effect of medicine, the way, the time, and the form in which it is administered, and also some other factors relating to the mode of living-all these affect the individual according to various circumstances. Therefore the physician should take all these factors into consideration for getting success in treatment.

There are no fixed rules for determining dosage. The property of each article of medicine requires to be considered

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first in fixing the dosage. The circumstances which modify the actions of medicines are very numerous. This modification depends in some instances on a peculiarity on the part of the patient; in others, on the character form and period of disease in which the medicine is administered; on the combination of medicines employed, on the strength of the active principles etc. The dosage of medicine, therefore, has rather to be regulated in accordance with the effect it produces in each individual case than to be made to depend on any writen directions on the subject. The dose depends upon the strength of the ingredients which virtually constitute their रूप, रस, गुण and कर्म considered both individually and collectively.

So, a dose means the quantity of a drug which is necessary to produce the required action, The largest quantity given to an adult without causing evil effects is called the 'maximum dose'; the smallest quantity necessary to obtain a physiological action is the 'minimum' dose. The following points merit the attention of the reader.

(b) **Modifying Circumstances Relating To The Patients:**

(1) **AGE:**

The dose varies considerably with the age of the patient. Much nicety is, therefore, sometimes necessary in regulating it. Ayurvedists have chalked out a rough scale as given in the following lines:—

प्रथमे मासि जातस्य शिशोर्भेषजरक्तिका ।
अवलेह्या तु कर्तव्या मधुक्षीरसिताघृतैः ॥
एकैकां वर्धयेत्तावद्यावत्संवत्सरो भवेत् ।
तदूर्ध्वं माषवृद्धिः स्यात् यावत् षोडशकाब्दिकाः ॥
षोडशाब्दात्ततस्तूर्ध्वं यावदासप्ततेरिति ।
एकमेव विभागोऽयं तदूर्ध्वं बालवत्क्रिया ॥ (Art. 80)

— सु. सं. सू. स्था. अ. ३५ डल्हण टीका.

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In modern medicine, " Young's " formula has been accepted in the case of children under twelve years. The rule is to divide the age in years by the age in years plus twelve ; the resulting quotient is the proper fraction of an adult dose. So, if N is the age of the child, the formula runs thus :

$\frac{N}{N+12}$ = the fraction of the adult dose. Thus the dose for a four-year child will be $\frac{4}{4+12} = \frac{1}{4}$ adult dose.

From twelve to sixteen years, ½ to 2/3 ; and from 17 to 20 years: 2/3 to 4/5 are the proportions.

In the case of patients above sixty the dosages should again be diminished slightly.

Dr. Pereira's scale in Guy's Hospital was :—

For patients between	Years.		Years.	Dose.
	21	and	45	1 Oz.
	50	,,	60	7 Drs.
	60	,,	70	6 ,,
	80	,,	90	5 ,,
	100.....			4 ,,.

(2) SEX :

Women require comparatively smaller doses. Their menstrual period should be taken into consideration. Drastic purgatives are not desirable during the period of menses and pregnancy.

(3) SIZE AND BODY WEIGHT :

Differentiation should be made between the thin and the robust.

(4) TEMPERAMENT AND DIATHESIS:

These influence the action of the medicinal agents. In this connection CHARAKA says

तस्मादातुरं परीक्षेत-प्रकृतितश्च विकृतितश्च सारतश्च संहननतश्च प्रमाणतश्च सात्म्यतश्च सत्त्वतश्चाहारशक्तितश्च व्यायामशक्तितश्च वयस्तश्चेति बलप्रमाणविशेषग्रहणहेतोः ॥१०५॥

—च. सं. वि. स्था. अ. ८ Art. 14-7-4

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Explanation: Individuals of वातल constitution can bear sedatives and anti-spasmodics ; those of पित्तल constitution can bear depressants but not stimulants : and those of कफप्रकृति can bear purgatives and bitter tonics.

(5) **IDIOSYNCRASY:**

Many persons are peculiarly susceptibile to the action of certain drugs. No reason can be assigned for this susceptibility. But the neurotic and the hysteric show this tendency. Previous to the exhibition of these remedies, particularly in the case of Mercury and Opium, it should always be ascertained if any idiosyncrasy with respect to them exists.

(6) **TOLERANCE and HABIT:**

(a) **Tolerance:** This may be of two kinds

(i) Inborn, which is usually called "Natural" tolerance.

(ii) Acquired: Certain drugs, after they are administered for a long time, fail to produce the same effect with the same dose. This is because the patient gets accustomed to them. This is 'acquired' tolerance.

(b) **Habit:** Sometimes the patient taking a drug becomes so addicted to its use that a craving for that drug is created in him. This craving is due to a habit formed by the patient. Opium-habit, alcohol-habit and cocaine-habit are instances.

(7) **PASSIONS and AFFECTIONS OF THE MIND :**

These have got a great influence in modifying the action of medicines, particularly that of narcotics. Narcotics do not produce the usual effect when administered to persons under the influence of great mental excitement, particularly anger and grief.

HOPE and CONFIDENCE : exert a most powerfully beneficient action. Faith in a particular medicine or in a particular practitioner does the same.

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(8) FASTING:

Drugs act more powerfully on an empty stomach than on a full one.

Other circumstances which modify the action of medicines:

(9) DISEASE :

Certain morbid conditions of the body greatly modify the action of medicines. For instance, in a severe spasmodic or painful affection larger doses of opium can be tolerated without much trouble; similarly mercury in syphilis and suppurative inflammation of the liver. Tetanus is a diseased condition which exhibits the greatest tolerance for medicines. Hysteria and Convulsions are other instances.

(10) CLIMATE:

It is a wellknown fact that atmosphere, both hot and cold, have their influence on dosage.

(11) SEASON:

This is also a modifying agent. Some diseases, independent of all remedial measures, improve in certain seasons and retrograde in others. Naturally, therefore, the remedial measures employed in such diseases are influenced indirectly but considerably by the season. Ayurved says that season has a direct influence on the constitution of drugs. For details see (सुश्रुत. सूत्रस्थान. अ. ६).

(12) ACCUMULATION :

Certain drugs have exceptional powers of accumulating slowly in the body until the quantity is sufficient to produce a poisonous effect. This is due to

(a) Rapid absorption and slow elimination of a drug. Mercury is an instance.

(b) Slow excretion due to fixation of the drug in the tissues. Gold is an instance; for, part of it is retained in the liver and muscle for a pretty long time.

(c) Sudden solution and absorption of a sparingly soluble drug owing to some changes in the contents of the intestines.

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It is, therefore, important for the practitioner to know whether the effects produced by the drug depend upon the amount taken during the previous six hours or the amount taken during the previous week.

III TIME OF ADMINISTRATION.

This is a very important factor in Treatment and so requires to be adjusted according to the vitality of the patient, his disease and the digestive organs concerned in the absorption of medicines. It bears relation also to the period at which food is taken by the patient. Medicinal remedies are of various kinds and as such they are intended for various purposes. There can, therefore, be no fixed rules to determine the time of administration. For, the healthy, eth convalescents, and also the diseased may all alike require some medicine or other to meet the varying conditions. Thus, children at the time of dentition, females during puerperium or at their menstrual periods, adults during the period following strenuous work, and old persons during the change of season, require some medicine to obtain relief. The times of administration in such cases depend upon their respective indications. Still the relationship between the times of administration of medicine and the times of food has to be considered well before any medicine is administered. For, a great majority of drugs are given by the mouth and as the drugs are not absorbed from the fundus of the stomach, there is a variable interval between the time the drug is taken and the time at which its absorption commences. It must be remembered that the stomach is a greatly variable organ of the body, both as regards its form and function. The cardiac portion acts as a reservoir for food and shows only feeble peristaltic activity. The mucosa of the pyloric portion, on the other hand, is much more susceptible to stimuli than the mucosa of the cardiac portion. The passage of food through the pylorus and into the duodenum sets up a highly complex series of reflexes which determine the rate at which digestion proceeds and at which the stomach is emptied. The reflexes prevent the entry of the gastric contents into the intestine until they have attained a certain uniformity of physical and chemical properties. The

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rate of the emptying of the stomach, therefore, depends upon a large number of factors : It is influenced by—

1. the rate and force of the peristaltic waves,
2. the nature of the stomach contents,
3. the sensibility of the duodenum,
4. the tonus of the fundus,

and 5. the rate of secretion of the gastric juice.

The time of administration of medicines, therefore, bears a close relation to the time of food, the condition of the stomach and the times of rest and exercise. The following instances are cited for information and guidance :

1. Gastric sedatives act better on an empty stomach and as such, stomachics and bitter tonics should be given half an hour before food.
2. Emetics are best given in the morning in view of the necessity of removing the undigested food taken during the previous night.
3. Purgatives are given both in the morning and at night. When speedy action is required, purgatives such as salines and castor oil are given in the morning on an empty stomach. But in the case of Aloes, Jalap and such other resinous cathartics which remain for a long time in the alimentary canal, night-time is preferable.
4. Diuretics are best given during daytime when the surface of the body can be kept moderately cool.
5. The time of administration of diaphoretics depends upon the circumstances of the case under treatment. They are generally given during the continuance of fever. Yet their successful operation depends upon certain conditions, e.g. warm bed-clothes, a recumbent position and an equable temperature.
6. Narcotics operate most favourably if administered an hour or two before the patient retires to rest.

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The times of administration of medicines have been stated clearly by almost all the Ayurvedic writers. Sharangadhara, who has almost copied from Wagbhata, gives the following directions :

भैषज्यमभ्यवहरेत्प्रभाते प्रायशोबुधः ॥६०॥
कषायांश्चविशेषेण तत्र भेदस्तु दर्शितः ।
ज्ञेयः पंचविधः कालो भैषज्यग्रहणे नृणाम् ॥६१॥
किंचित्सूर्योदये जाते तथा दिवसभोजने ।
सायंतने भोजने च मुहूश्चापि तथा निशि ॥६२॥
प्रायः पित्तकफोद्रेके विरेकवमनार्थयोः ।
लेखनार्थं च भैषज्यं प्रभाते नान्नमाहरेत् ॥६३॥
एवं स्यात्प्रथमः कालो भैषज्यग्रहणे नृणाम् ।
भैषज्यं विगुणेऽपाने भोजनाग्रे प्रशस्यते ॥६४॥
अरुचौ चित्रभोज्यैश्च मिश्रं रुचिरमाहरेत् ।
समानवाते विगुणे मंदेग्नावग्निदीपनम् ॥६५॥
दद्याद्भोजनमध्ये च भैषज्यं कुशलो भिषक् ।
व्यानकोपे च भैषज्यं भोजनांते समाहरेत् ॥६६॥
हिक्काऽक्षेपक कंपेषु पूर्वमंते च भोजनात् ।
एवं द्वितीयकालश्च प्रोक्तो भेषज्यकर्मणि ॥६७॥
उदाने कुपिते वाते स्वरभंगादिकारिणि ।
ग्रासेग्रासांतरे देयं भैषज्यं सांध्यभोजने ॥६८॥
प्राणे प्रदुष्टे संध्यायां भक्ष्यस्यांते च दीयते ।
औषधं प्रायशो धीरैः कालोऽयं स्यात्तृतीयकः ॥६९॥
मुहुर्मुहुश्चतृट्छर्दिहिक्काश्वासगरेषुच ।
सान्नं च भेषजं दद्यादिति कालश्चतुर्थकः ॥७०॥
उर्ध्वजत्रुविकारेषु लेखने बृंहणे तथा ।

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पाचनं शमनं देयमनन्नं भेषजं निशि ॥७१॥
इति पंचमकालः स्यात्प्रोक्तो भैषज्यकर्मणि ।

—शा. सं. प्र. खंड अ. २

IV. COMBINATION OF DRUGS :

(a) Antagonism :

A judicious combination of drugs is generally more effectual in its operation than a single drug, however well selected. It is an object of particular importance for the practitioner that he should make himself well acquainted with those several combinations which either increase or diminish the action of certain remedies.

The process by which the action of a drug is either weakened or prevented by the action of another in combination with it, is known as 'Antagonism'. Antagonism may be chemical or pharmacological.

(b) Synergism :

Synergism means the augmentation of the action of one drug by the action of another. In forming a combination, attention should be paid to the chemical and pharmacological actions of drugs. Similarly the unpleasant and undesirable properties of a drug in a prescription should be corrected by 'corrigens or correctives.'

Simplicity should be the rule in this respect (combination). Attempts should not be made to fulfil too many indications at one time, as it is quite probable that a correct estimation of the remedies used is likely to be missed.

V. INCOMPATIBILITY :

As a general rule, a prescription should not contain such ingredients which can counteract one another either, physically chemically, or pharmacologically. If they do so, they are called 'incompatibles'.

Incompatibility, therefore, can be of three kinds :

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1. **Physical :**

   This occurs when the ingredients do not mix well, nor form a clear solution.

2. **Chemical:**

   This occurs when the inter-action between the two soluble salts in the mixture results in the formation of another compound.

3. **Pharmacological:**

   This occurs when drugs possessing opposite actions arecombined.

Both CHARAKA and SUSRUTA have explained the importance of this subject in Sutrasthana by devoting special chapters to it. The circumstances affecting the prescription of diet are given in greater detail by CHARAKA in Sutrasthana, chapter 26. These instructions are equally applicable to the administration of medicines also. They are, therefore, given here below :

Medicines should not be

1. देशविरुद्ध in antagonism to Climate and Soil.
2. कालविरुद्ध in antagonism to Season.
3. अग्निविरुद्ध in antagonism to digestive capacity of juices.
4. सात्म्यासात्म्य in antagonism to the Constitution and diathesis of the patient.
5. संस्कारविरुद्ध in antagonism to the mode of preparation.
6. रसविरुद्ध वीर्यविरुद्ध incompatible Pharmacologically.

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7. कोष्ठविरुद्ध — detrimental to the Condition of the Digestive Organs, in relation to their susceptibility.

8. अवस्थाविरुद्ध — affecting the General Condition of the patient with reference to the time of administration,

9. क्रमविरुद्ध — such as would disturb the methods of arrangement in the administration of drugs.

10. परिहार, उपचार } विरुद्ध — inconsistent with the nature of the courses (menu) prescribed, e.g. heterogeneous articles.

11. पाकविरुद्ध — violating the rules of the preparations of drugs.

12. संयोगविरुद्ध — incompatible, either chemically or physically.

13. हृद्विरुद्ध — such as would disturb the mental attitude, e.g. those creating aversion towards certain drugs.

14. संपद्विरुद्ध — deficient in pharmacological or nutritional properties.

15. विधिविरुद्ध — such as would affect the actual way or procedure in which food is taken.

VI. **Prescription for Children:**

Great caution is necessary in prescribing medicines to children.

The following hints will be found useful by the reader:

1. Care should be taken in deciding the dosage, bulk, and the form of the medicines to be administered.

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2. Medicine should be palatable, e. g. castor oil is easily taken by the infants, but older chidren refuse it. It should, therefore, be given in the form of emulsion, made sweet.

3. Knowledge of the susceptibility of children, towards certain drugs is essential. Belladona and Hyoscyamus are well borne by children, but opium is not wel tolerated by them. Strong or poisonous medicine. should better be withheld, but when their administration is necessary every possible care should be taken to study the tolerance of children for those particular drugs. Divided doses are, therefore, always safer than full or concentrated ones.

SECTION VI.

WEIGHTS AND MEASURES.

(A) **Ayurvedic System** :

8 Sarshpa सर्षप = 1 Yava यव

4 Yava यव = 1 Ratti or Gunj. रत्ति or गुंज

6 Ratti रत्ति = 1 Masha माष

4 Masha माष = 1 Shana, Dharana, Tank, Nishka. शाण, धरण, टंक, निष्क.

2 Shana शाण = 1 Kola कोल.

2 Kola कोल = 1 Karsha, Aksha, Bidalapadaka, Kavalagraha. कर्ष, अक्ष, विडालपदक, कवलग्रह = is one tola in practice.

2 Karsha कर्ष = 1 Shukti, Ardhapala शुक्ति, अर्धपल.

2 Shukti शुक्ति = 1 Pala पल, 4 tolas in practice.

2 Pala पल = 1 Prasriti प्रसृति

2 Prasriti प्रसृति = 1 Anjali, Kudava, Ardha-sharava अंजली कुडव, अर्धशराव = 16 tolas.

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2 Anjali	अंजली	=	1	Sharava, Manika	शराव, माणिक	= 32 tolas
2 Sharava	शराव	=	1	Prastha	प्रस्थ	= 64 tolas.
4 Prastha	प्रस्थ	=	1	Adhaka	आढक	= 256 tolas.
4 Adhaka	आढक	=	1	Drona	द्रोण	= 1024 tolas.
2 Drona	द्रोण	=	1	Shoorpa	शूर्प	= 2048 tolas.
2 Shoorpa	शूर्प	=	1	Droni	द्रोणी.	
4 Droni	द्रोणी	=	1	Khari	खारी.	

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100 Pala	पल	=	1	Tula	तुला,	400 Tolas.
2000 Pala	पल	=	1	Bhara	भार.	

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Measures current in Bombay Presidency.

1 Gunj	गुंज	=	1	Ratti	रत्ति.	
6 Gunj	गुंजा	=	1	Ana	आणा.	
8 Gunj	गुंजा	=	1	Masa	मासा.	
12 Masa	मासा	=	1	Tola	तोळा	= 180 grains.
5 Tolas	तोळा	=	1	Chataka	छटाक	= 2 ounces.
16 Chataka	छटाक	=	1	Seer	शेर	= 32 ounces = 80 tolas.

British (Imperial) Weights.

1	Grain	=	1	Gr. 1/ 180 Tola.
20	Grains	=	1	Scruple.
60	Grains	=	1	Drachm.
437.5	Grains	=	1	Ounce.

Liquid Measures.

1	Minim	=	1	Min. (abbreviation or symbol).
60	Minims	=	1	Drachm (Dr.).
8	Drachms	=	1	Ounce (Oz.).

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20	Ounces	=	1	Pint (oi).
8	Pints	=	1	Gallon (Ci). About ten pounds.
1	Gutta (Gtt)	=	1	Drop; supposed erroneously to represent one minim.

English Domestic Measures.

One teaspoon-ful	=	1	Fluid drachm or a little more.
One dessert spoonful	=	2	Fluid drachms approximately.
One table spoonful	=	4	Fluid drachms or about 1/2 Oz.
One wine glassful	=	2	Fluid ounces or a little more.
One gill	=	4	Fluid ounces or a little more.
One tea-cupful	=	5	— 7 Fluid ounces.
One breakfast-cupful	=	8	Fluid ounecs.
One glassful	=	12	Fluid ounces.
One tumbler-ful	=	15	to 20 Fluid ounces.

These are only average measurements; for no cup or spoon is of the same size.

Metric System

10	Centimil	=	1	Decimil	=	1. 6894 Minims.
10	Decimil	=	1	Mil.(1c.c.)	=	16. 8941Minims.
10	Mils (c.c.)	=	1	Centilitre	=	2.8157 Fl. Drachms.
100	Mils(c.c.)	=	1	Decilitre	=	3.5196 Fl. ounces.
1000	Mils(c.c)	=	1	Litre	=	1 7590 Fl. Pints.

Measures–Imperial to Metric.

1	Minin	=	0.03 c c.	Approximately.
15	Minims	=	0.9 c. c.	
60	Minims	=	3.5 c. c.	
1	Fl. Oz.	=	30 c. c.	
1	Pint	=	568.0 c. c.	
1	Gallon	=	4.536 Litres.	

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Weights.

10	Milligram	=	1	Centigram	= 0.154 Grains.
10	Centigram	=	1	Decigram	= 1.543 Grains.
10	Decigram	=	1	Gram	=15.432 Grains.

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10 Gram	= 1 Decagram	= 0.3527 Oz. Avord.	
10 Decagram	= 1 Hectogram	= 3.5274 Oz. Avord.	
10 Hectogram	= 1 Kilogram	= 2.2046 lb. Avoirdupois.	

Weights–Imperial to Metric.

1 Grain	= 0.065	Gram.	Approximately.
15 Grain	= 1.0	Gram.	
30 Grains	= 2.0	Grams.	
60 Grains	= 3.9	Grams.	
90 Grains	= 6.0	Grams.	
½ Oz. (A.V.)	= 15.0	Grams.	
1 Oz. (A.V.)	= 30.0	Grams.	
1 Pound (A.V.)	= 453.59	Grams.	

Length.

1 Metre (m)	= 39.370113	Inches.
1 Centimetre (cm)	= 0.39370	Inches.
1 Millimetre (mm)	= 0.039370	Inches.
1 Micron (u)	= 0.00003937	Inches.
1 Inch (in)	= 35.3999	Millimetres.

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Pharmaceutical Processes.

Various processes are employed in Pharmacy to render a drug fit for medicinal use. The following are some of the principal processes used in Ayurvedic Pharmacy.

(1) **Bruising or contusion** is a process by which hard, tough or soft substances like roots, bark or leaves of medicinal plants are smashed or broken-up in a disintegrator or a crushing mill. The house-hold pestle and mortar may be used for this purpose when required on a small scale.

(2) **Calcination or incineration** is a process by which drugs are exposed to high temperature in order that the watery and volatile constituents should be driven off. The substances are, however, not heated to their fusing point. This operation is sometimes known as roasting.

(3) **Sifting** is a process by which fine powders are separated from coarser ones by means of a sieve which is made of either wire or muslin of varying degrees of fineness. Several terms to indicate the degree of comminution are in use. They are as follows. (1) Coarse powders (2) Moderately coarse powders (3) Moderately fine powders (4) Fine powders (5) and Very fine powders.

(4) **Distillation:** this process consists in the evaporation of a volatile substance, or substances by the application of heat and subsequent condensation of the vapour into a liquid form by cold. It is usually applied for separating volatile substances from fixed constituents, as also for mixing volatile substances which otherwise could not be mixed.

Destructive or dry distillation is a process in which heat is applied to decompose a substance into volatile products which did not exist in it originally, and which are then collected in a receiver. Acetic Acid and wood-tar are obtained by this process.

(5) **Crystallisation:-** Solid bodies are divided into two groups (1) those which are capable of forming crystals,

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(ii) and those which cannot be crystallised. The process of crystallisation consists in obtaining the bodies in a crystalline form from a solution either by evaporation, cooling, precipitation, fusion or by sublimation. The size of crystals varies as the process is carried on slowly or rapidly.

(6) **Elutriation** is a process by which a substance is pulverised and mixed with water ; in this operation the heavier grains settle to the bottom, while the lighter ones are poured off with the fluid into another vessel. Here the deposition takes place slowly. Sand, gravel and other impurities are separated by this process.

(7) **Expression** is a process by which juices and oils are pressed out from vegetable substances, as in the preparation of succi (Swa-Rasa). When the manufacturing is on a large scale squeezing processes are used. Generally articles which are pulpy and soft with juicy material, such as the " Citrus " (Lemon), are best suited for such treatment.

(8) **Maceration** is a process of steeping a substance in some suitable solvent, such as alcohol without the application of heat, in order to dissolvs its soluble matter. The insoluble residue is called " Marc ". The drugs must be soluble ones for the success of this operation. Maceration serves as an initial step for further treatment.

(9) **Digestion**: consists in extracting the essential principles by the aid of warm liquids which are not of a boiling temperature. Digestion thus differs from maceration in that it requires the assistance of heat. The important advantage of this process lies in the fact that it allows perfect solution of all soluble properties of a substance without modifying the nature of the solvent.

(10) **Infusions** can be either hot or cold. Infusions are watery solutions of vegetable principles, prepared by soaking in water, hot or cold, coarsely powdered drugs for a certain time in a covered vessel and then straining the supernatant liquid. These are called Phant (फांट) and Hima (हिम) respectively.

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(11) **Decoction.** The process of decoction is applied for the extraction of drugs the constituents of which are water-soluble. The process consists in boiling the bruised drug in water in an open vessel till the required strength is reached. It is then strained and used.

(12) **Percolation** is a process in which alcohol or some other suitable liquid is poured over, or made to pass through, a coarsely powdered drug, with the object of dissolving and carrying along with it the active substances contained in the drug. The fluid thus collected is called a percolate. The liquid used as a solvent in the process is called a menstruum.

(13) **Decantation** is a process for the successful operation of which solid ingredients are first dissolved in a liquid or held in suspension, and then allowed to be deposited at the bottom of the vessel. As the upper layer of the liquid, after a time, becomes clear it can be decanted or drawn off with the aid of a siphon.

(14) **Filtration** consists in the removal of undissolved solid particles from a fluid to such an extent that the fluid becomes transparent. This is done by filters where-in the medium used is either charcoal, sand or a filter-paper.

(15) **Evaporation** is a process meant for the evaporation of a fluid into vapour by means of heat, diminished atmospheric pressure or exposure to dry atmosphere.

Sometimes the fluid is not allowed to come in contact with the source of heat. In such cases, the evaporation is conducted on water-bath or sand-bath, or with the aid of steam.

(16) **Lixiviation** consists in the separation of soluble salts from a solid compound by dissolving the latter in water and decanting the supernatant liquid into another vessel. The liquid is then evaporated to dryness where-by the insoluble residue is left behind. The decanted solution is called a "lye".

(17) **Trituration** is a process by which a solid is reduced to a very fine powder by continuous rubbing in a morter.

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(18) **Levigation** is another process of trituration with the aid of a liquid in which the finely comminuted particles are gathered with the washings and allowed to deposit slowly; the coarser particles are again ground with the liquid until the whole of the solid is reduced to a fine powder.

(19) **Sublimation** is a process in which a volatile solid is first vaporised by heat, and then the vapour so formed is condensed as a deposit on the surface of another vessel. The deposit is called 'sublimate.' The deposits are known as flowers when they are in a fine feathery state.

In Ayurved, an apparatus called "Urdhwa-Patana-Yantra (ऊर्ध्वपातनयंत्र) is used for sublimation. It consists of an earthen vessel in which the volatile solid is placed. This is covered over with another hollow earthen basin (mouth down-wards), and their edges are hermetically sealed with clay. To the lower dish heat is applied, while the upper is kept cool by means of wet rags.

(20) **Fusion** is a process by which a solid body is melted or liquified by heat. This process is used in the preparation of plasters, ointments, suppositories etc. Furnaces and water-steam or sand-baths are used for melting purposes.

(21) **Despumation** is a process by which an organic fluid is boiled until the impurities rise to the surface as scum, which is then removed by skimming or straining. Syrups made by this process keep longer.

(22) **Desiccation** is a process by which a solid is deprived of its moisture. This is effected by either exposing a substance to the Sun or warm weather, or placing it in a warm chamber.

(23) **Precipitation** consists in the separation of a solid from a liquid in which it is dissolved. This is generally effected by chemical reaction, but sometimes advantage is taken of the different degrees of solubility of that substance in particular liquids. Hence the solid soluble in alcohol can be precipitated if water is added to the solution. Sometimes heat or light produces precipitation, as in the case of albumen, silver salts etc.

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APPENDIX I.

VITAMINES.

Introduction:

Till the end of the 19th century it was almost held that the caloric value of the food-stuffs was the all-important factor in nutrition. Further observations showed that in addition to the different proximate principles of food there are certain accessory materials that are necessary to normal growth and development. The first attempts at isolating these substances showed that they exist in the foods in very minute quantities, and that they disappear when food is preserved. During the last two decades and a half, knowledge of Vitaminic Chemistry has advanced very rapidly and the chemical constituents of most of the Vitamines is now known. They are regarded as a group of substances that have been collected together under a common name given to them accidentally during the course of their discovery.

Vitaminic research really commenced in 1881 when Lunin showed that mice could not live on a diet consisting purely of proteids, fats, carbohydrates and salts. Peckel sharing's investigations made in 1905 showed the same results. He showed that there was an unknown substance in milk which was of paramount importance to nutrition. In 1906, Hopkins, after many unsuccessful attempts at rearing rats and mice on highly purified substances alone, came to the conclusion that an animal, in order to live, required many substances besides the purified proximate principles. Funk introduced the term 'Vitamine' in connection with the attempts he made to isolate the active principle present in rice polishings.

These discoveries led to a definite progress in research work and by 1918 it was recognised that at least three separate accessory food-substances or Vitamines existed, and that the presence of all these in the diet was essential for the mainte-

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nance of life. Since then the number of these substances recognised one by one, has increased slowly but steadily. They have been named A, B, C and D in the order of their recognition. But this system of nomenclature is beginning to break down, because the term 'Vitamine B' has been found to cover a large variety of different substances all of which are present in Yeast extracts.

Vitamines, their Properties and Deficiency-symptoms:

The part played by vitamines in physiology can be appreciated most easily if they are regarded as a portion of the mechanism of the chemical control of body-functions. In the case of vitamine B1, B2 and C it is found that they form part of the enzyme mechanism by which the normal metabolism of the cell is carried out. Vitamine D is found in the skin by the irradiation of ergosterol by the ultra-violet light from the sun. In high latitudes, in winter, this vitamine has to be obtained from the food.

The body needs a wide variety of substances for repairs; some of these it can manufacture, but others it has to obtain ready-made. The latter fall into two groups, viz., those which are stable, and those which are easily destroyed. Metalic salts like those of iron are stable ones. The unstable group of substances are present in fresh food, vegetables or fruits but are easily destroyed by processes used in food-preservation, and these are Vitamines. Both of these groups enter into the composition of blood through the food-stuffs that animals eat. But as vitamines are produced only in plants they pass directly with vegetable foods but indirectly with animal foods, into the human system.

It has been observed that a total deprivation of these vitamines in the case of rapidly growing animals lead to diseases, now known as 'deficiency-diseases.'. The most common of these diseases are Scurvy, Beriberi, Rickets and Pellagra. Recent investigations have led to the discovery of minimum human needs of the various vitamines. It is important to

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remember that the minimum requirement is not the same as the optimum supply. The aim of nutrition is not to discover the deficient diets on which human beings can manage to survive, but the diets optimum for the maintenance of full health and activity.

The effects provided by complete Vitamin-lack are much easier to recognise than are the effects of partial deficiency, and these latter are more important in the investigation of disease.

Vitamin deficiency may arise from three causes :

1. Deficiency of vitamins in food,
2. Failure to absorb vitamins from food,
3. Conditions in which vitamin-needs are increased.

It is needless to state that simple food-deficiency is much the commonest cause of vitamin-lack; but the failure to absorb is not an uncommon factor also in the causation of the extension of disease. The simplest example of this is the fact that chronic Gastritis may prevent the absorption of water-soluble vitamins. Similarly obstructive Jaundice prevents the absorption of vitamin K, and this leads to a tendency of bleeding which is noticed in Cirrhosis of the Liver.

The conditions in which the vitamin-needs are high, are present in growing children and pregnant females.

Classification of Vitamins:

It is usual to follow Mc Collum's classification which is based on the relative solubilities of Vitamins in water or fats.

The fat-soluble group contains:

1. Vitamin A, the growth-promoting Vitamin.
2. Vitamin D, the anti-rachitis Vitamin.
3. Vitamin E, the anti-sterility Vitamin.

and 4. Vitamin K, the Coagulation Vitamin.

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The Water-soluble group contains:

1. VitaminB1, the anti-neuritic Vitamin.
2. Vitamin B2 Complex comprising.

   (a) Riboflavin (Lactoflavin), concerned with normal fat-metabolism.

   (b) Acidum Nicotinicum, a Pellagra-preventive Vitamin.

   (c) Vitamin B_6 (Pyridoxine)

   (d) Pantothenic acid

   (e) Folic acid

   (f) Biotin

   (g) Inositol

   (h) Choline

   (i) Para-Amino-Benzoic acid.

3. Vitamin C, or Ascorbic Acid-the Anti-Scorbutic factor.

and 4. Vitamin P, or Hesperidin, —the Anti-Haemorrhagic factor.

I FAT—SOLUBLE VITAMINS.

Vitamin— A.

The growth and anti-infective factor.

(a) Sources: Vitamin A is derived by animals from the Carotenoid plant pigments and Crypto-zanthine, which occur in green vegetables and cereals; but animals concentrate this vitamin in their fatty tissues, hence it is found richly in whole milk, cream, butter, egg-yolk, cod-liver oil and halibut liver oil, and in the viscera of fishes.

Chlorophyll in green vegetables is an indirect source of this vitamin. Cereals and nuts are, in general, poor in this factor.

It is absent from lard and vegetable fats.

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(b) **Chemical Characters:** It is stable to heat, but readily destroyed by acids, oxidizing agents (when impure) or ultra-violet light. It can be got without vitamin D from concentrates of mammalian liver-oil; and when pure, it is a pale yellow viscous oil.

(c) **Standard for Vitamin A:** The international unit is the specific activity contained in 0.6 microgram of the standard preparation of pure B Carotene. Pure vitamin A has an activity of 3,000,000 units per gramme.

(d) **Daily Human Requirements of Vitamin A:**

(1) For Adults:..... 2,000 to 4,000 units.

(2) For Children:..... 6,000 to 8,000 ,,

(3) For Pregnant women :..... 5,000 units.

(e) **Symptoms of Deficiency:** Deficiency of vitamin A produces (1) retardation of growth, (2) degenerative changes of keratinization of the epithelium in the mucous membrane of the nose, trachea and bronchi, (3) atrophy of the cells of the salivary glands the mucous glands of the intestines and of the intestinal villi, (4) imperfect development of the periodontal tissues, (5) dryness of the skin and liability to papular eruptions, (6) Xeropthalmia or Keratomalacia, exhibited by virulent conjunctivitis with corneal thickening and ulceration, (7) cessation of regeneration of the visual purple and so production of night-blindness, (8) paralysis of various types from demyelination of the spinal cord, (9) decrease in number of blood-platelets, (10) proliferation of cancellous at the expense of compact tissue, (11) development of phosphatic Calculi.

Animals deprived of vitamin A become more susceptible to bacterial infections owing to the degenerative changes in the epithelial protective membranes of the body.

(f) **USES:** Vitamin A is necessary for proper growth of the young and for maintaining the integrity of the proper

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structure and function of the nervous system. Persons who are on normal dietary are not benefited by vitamin A, even if it is administered in large doses.

Vitamin—D. —The Anti-rachitic Factor.

Sources and Characters: It is a fat-soluble vitamin with antirachitic properties, and splits up into D1, D2 and D3 which are sterols with anti-rachitic properties. Out of these vitamin D 2 has been recognised under the name 'Calciferol'. Vitamin D is produced in plants, in food-materials and also in animals, whenever ergosterol is present and is subjected to ultra-violet rays. Ergosterol is a crystalline compound with a structural formula similar to cholesterol. When ultra-violet light acts on ergosterol a yellowish resin is produced. This 'irradiated ergosterol' is a mixture of vitamin D and other non-active products. Continued irradiation destroys the vitamin.

When the body is exposed to ultra-violet rays vitamin D is synthesised from ergosterol in the superficial layers of the skin and subsequently absorbed in the circulation.

Vitamin D consists of white needle-like crystals insoluble in water, soluble in alcohol and in 50 to 100 parts of vegetable oils.

Vitamin D is richly present in cod-liver oil, milk, cream, butter, and egg-yolk. It is prepared by the action of ultra-violet rays on ergosterol, milk, yeast and other foods.

Green vegetables contain very little of this factor.

Standard for vitamin D : The international unit of Vitamin D is the activity of ·025 ng. Calciferol, i.e., one milligram of calciferol contains 40,000 units of antirachitic activity (Vit. D). The minimum daily need is about 100 units a day and the optimum supply is probably about 1000 units a day or 0·025 Mgm.

The symptoms of deficiency: Deprivation of Vitamine D produces rickets and defective calcification of the teeth from lackof calcium or phosphorus. Rickets may arise whatever the relative or absolute intake of calcium and phosphorus, if Vitamin D is absent from the diet ; but in its presence a

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proper balance of calcium and phosphorus absorption and utilization is ensured. The vitamine increased the power of the blood to carry more calcium and phosphorus in balanced proportions to be deposited on the bones. One of the primary effects of vitamine D deficiency is to render the gut-contents more alkaline and thus to interfere with the absorption of calcium.

In rickety children the bones, being soft and spongy bend under the weight of the body. The defective calcification of the epiphyses is shown by radiographs.

When Vitamine D is deficient in diet, the teeth on eruption exhibit malformations together with superficial irregularities and a pitted appearance; sections reveal that the enamel, and dentine are about one-third their normal thickness and imperfectly calcified, while the dentinal tubules are irregularly formed and show irregular spaces.

Cereals, if they form a high proportion of the diet, have a deleterious influence on the calcification of teeth, but Vitamine D counteracts this defect.

Uses : Calciferol and foods containing vitamine D are prophylactic and curative for rickets. They are advisable for children living under conditions of malnutrition, and who are deprived of fresh air and sunlight.

Children suffering from caries of teeth are benefitted by its use ; since the vitamine helps the absorption of calcium it is desirable that some form of calcium is given with it.

Calciferol or food rich in vitamine D will also improve the condition known as osteomalacia from which women suffer due to repeated pregnancy and lactation, and want of proper food, fresh air and sunlight. Again, if mothers are made to receive prenatally and post-natally adequate supplies of this vitamine they will naturally pass it on to the infants, and as a consequence of this, efficient calcification of infantile teeth is ensured.

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Vitamine D often improves infantile tetany, and also hay fever, arthritis and psoriasis. It is of service in promoting the healing of fractures. The anti-rachitic principle in fish oils and other natural sources is more efficacious in treatment than calciferol. For therapeutic purposes cod-liver-oil and certain other oils are valuable, and in some cases proprietory preparations of irradiated ergosterol of stated potency are useful.

Hyper-vitaminosis.: Huge doses of vitamine D cause a marked increase in the calcium content of the serum and deposition of calcium in the blood-vessels (Aorta, Coronaries etc), kidneys, lungs. Calculi may form in the bladder. Atrophy of the spleen and thymus, and a loss of weight may also occur. There is no reason to fear such effects from ordinary doses.

Mild symptoms of intoxication due to excess of irradiated ergosterol have been reported in children ; the first effect produced is loss of appetite.

VITAMINE—E

The anti-sterility factor.

Source and characters.—It is a fat soluble vitamine and can be extracted by fat-solvents like light petroleum, ether, absolute alcohol, benzene etc. It withstands heat to a remarkable extent and in that respect resembles vitamine A. But under certain conditions it is susceptible to oxidation.

It is found in abundance in the embryos of seeds and green vegetables, chiefly lettuce, cotten-seed, maize, peas, oats, corns, and wheat-germ-oil.

It has been isolated in a crystalline form under the name of Tocopherol, having the formula $C_{29}H_{50}O_2$. It is a complex alcohol having a benzene ring.

Standard and dose: Vitamine E is now available either in the form of concentrates from wheat-germ, oil or as a synthetic product. A suitable daily human dose is an amount equivalent in

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biological activity to 13 Mgm. of Tocopherylis Acetas (B.P.C.)

Symptoms of deficiency : Deficiency of Vitamin E, in the diet of males leads to sterility through destruction of germ-cells and eventually of the entire seminiferous epithelium. Spermatozoa become inactive, and so azoospermia and impotence occur. In the female sterility also results, but in an entirely different way. Successful mating can occur, and the preliminary stages of gestation may be normal, but after sometime the foetuses die owing to pathological changes in the placenta. Essentially therefore the deficiency leads to abortion. In cases where animals have received inadequate quantities of vitamin E, the anterior pituitary glands show degenerative changes. Vitamin E deficiency not only reduces the production of the gonadotropic hormones but there also is evidence that it reduces the production of prolactin.

The observations mentioned above suggest that a partial deficiency of vitamin E may be responsible for a proportion of human neo-natal mortality. Moreover animal experiments suggest that this deficiency favours the occurence of toxaemia of pregnancy.

Uses: Vitamin E or Tocoferol has been used in the treatment of premature labour, habitual and threatened abortion, premature separation of placenta, certain cases of toxaemia of pregnancy, and to correct inadequate lactation ; but the evidence of its action in the human system is not very encouraging.

It has been used in muscular dystrophy, amyotrophic lateral sclerosis, and tabes dorsalis with some improvement of muscular wasting and general condition, and mental out-look.

Concentrates, by removal of the fatty acid glycerides, e.g. Viteolin, Ephynal, Phytoferol, Germanin etc., have also been used in cases where the vitamin is indicated.

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VITAMIN K

COAGULATION VITAMIN

Sources and characters. It is a fat-soluble vitamin first found in the Liver-Oils. It is also richly present in green leaves of alfalfa, cabbage and spinach, in strawberry and tomato, soya-bean and wheatgerm. It belongs to a group of Naphthoquinone derivatives. It occurs in two forms, K_1 and K_2. The first is generally used under the name Menaphthonum (Kapilon). It is an yellow oil and has been synthesised. It is not absorbed from the intestines, in the absence of bile-acids. When given orally it is desirable to give bile-salts along with the vitamins.

Dose: Menaphthonum is insoluble in water, but slightly soluble in alcohol. It is destroyed by exposure to light. It is given in doses of 1/12 to 1/6 grain (5 to 10 Mg.). The synthetic product 2-Methyl-1:4-Naphthoquinone is generally used in practice, and is given intramuscularly.

Actions and Uses: Vitamin K is essential for the formation of prothrombin and its deficiency retards coagulation of blood. Vitamin K raises the prothrombin content to normal within 24 to 48 hours. If given orally in cases of jaundice, five grains of bile-salts should also be given; otherwise this fat-soluble factor is not absorbed. To secure prompt action it should be given by intramuscular injection, in doses of 5 to 10 Mg., in 0.5 Per-cent solution of Arachis Oil.

It has also been found useful for minimising post-operative bleeding in cases of jaundice, and for preventing and treating hoemorrhagic diseases of the new born.

Aceto—menaphthonum is a preparation which is given orally in tablets to expectant mothers during a week before labour. The dose is 1/6 to 1 grain.

WATER SOLUBLE VITAMINS

Vitamin B. This is a water-soluble vitamin and contains a large variety of different substances all of which are present in yeast extract; some of these have at present an undetermined composition and nomenclature.

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The term vitamin "B" complex is applied to a group of substances formerly thought to be only one entity and called vitamin "B". There are now known to be atleast a dozen water soluble factors commonly occuring together in nature, as in liver and yeast, and included under the term "Vitamin B-complex". The names of these have been already given before.

The important ones are :

(a) Vitamin B_1 or 'Thiamine' or Aneurin'.

(b) Vitamin B_2 complex, which includes (1) Riboflavine or Lactoflavine and (2) Nicotinic Acid or Nicotinic amide.

Sources of vitamin B. Vitamin B factors are richly available in the germs and outer layers of cereals and legumens, in yeast and nuts, but are also present in vegetables, fruits, egg-yolk, milk and meat (especially pork, liver and kidney). They are absent in white bread but present in wholemeal bread.

Vitamin B_1 Aneurine Hydrochloride, or Thiamine Hydrochloride.

Characters: It is amino-peptide hydrochloride containing Cl, N and S and is a white crystalline powder. It is readily soluble in water. Its odour and taste are bran-like. It should be protected from light during storage. It withstands boiling in acid medium, is more stable than vitamin C, but less so than other vitamins. It is easily destroyed by oxygen in alkaline solution.

Standard and Dose : Aneuric Hydrochloride possesses antineuric properties and contains in one gram 320.000 units of antineuritic activity (Vitamin B_1). The international unit is defined as the antineuritic potency of 10 Mg. of the absorbate of vitamin B_1. Pure crystalline Vitamin B_1 has an activity of 500 international units per Mg.

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Dose : Prophylactic, daily 100 to 200 units ;
Imperial, 1/200 to 1/100 Grains.

Deficiency symptoms: In man, the deficiency, if continued, long, causes intestinal stasis, wasting (loss of tone) of the bowels, retention of the putrid food residue and absorption of products of putrifaction and auto-intoxication. Its total absence causes beri-beri and analogous disease in animals. This is characterised by anorexia, loss of flesh and strength, polyneuritis, oedema and bradycardia. Minor degree of deficiency in children causes retardation of growth, poor appetite, constipation neuritic pains and tenderness of muscles.

The daily requirement of adults is 300 to 500 units. That in pregnancy and childhood is greater than this.

Actions and Uses: Thiamin is essential for the normal intermediate metabolism of carbohydrate. Deficiency of Thiamin, therefore, deranges cellular metabolism, and probably affects most organs in the body. Excess of carbophydrates in the diet increases the need for thiamin. The pyrophosphoric ester of vitamin B_1 is essential for the oxidation of pyruvic acid into carbon-dioxide and water. In its absence pyruvic acid and also lactic acid accumulate in the blood, and therefore the nerve-cells fail to function properly as in the case of beri-beri. The nervous system and the heart are the organs most markedly affected.

It follows therefore that it is useful in beri-beri which is characterised by anorexia, loss of flesh and strength, polyneuritis, oedema and bradycardia. It has also been found useful in various types of neuritis, such as those caused by alcohol lead and arsenic. It promotes peristalsis and maintains the normal nutrition of the gut. It is useful in vomiting of pregnancy and atonic constipation, and in cardiac weakness. Anything that increases metabolism, such as muscular work, fever, pregnancy or hyperthyroidism, increases the amount of this vitamin requirement. The body does not store this vitamin, and any excess over the immediate requirement is excreted by the urine.

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It may be administered by the mouth in the form of solution or tablet, or may be administered by subcutaneous, intramuscular or intravenous injection. Parenteral therapy is suitable to cases where gastric secretion of Hydrochloric acid is defective.

Dose: 2 to 10 Mg. (1 Mg.=500 units).

Berin, Betaxin, Marmite-an yeast extract, and Bemax from cereal embryos, are concentrates of vitamin B.

VITAMIN B_2 COMPLEX.

This is composed of two factors.

(a) Riboflavin: (Lactoflavin) responsible for growth-promoting properties.

(b) Nicotinic acid: pellagra preventive.

Riboflavin: Source and characters:- This is a water-soluble yellow pigment, first isolated from milk (lactoflavin). It is also found in yeast, milk-whey and liver extract. When its phosphate is conjugated with protein, it forms the "respiratory enzyme" of the tissues, which is essential for the oxidation of carbohydrates, aldehydes, lactic-acid and amino-acids. The alkaline solution, of Riboflavin deteriorates if exposed to light.

Dose: Imperial. 1/60 to 1/6 Grain.
Metric. 0.001 to 0.01 Grm.

Deficiency symptoms:

(1) Linear fissures (cheilosis) appear at both angles of lips, which are red and shiny.

(2) The tongue becomes magenta-red, and its papillae are flattened.

(3) A scaly seborrhoeic or grey desquamation with crusts may form at the angles of the lips, nostrils, eyelids and upon the ears.

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(4) Photophobia, visual impairement in dim light, lachrimation and a sensation of itching or burning in the eyes, associated with circum-corneal injection precede the development of keratitis.

(5) Degenerative changes in the spinal cord and peripheral nerves are sometimes noticed.

Uses: Riboflavin is absorbed from the alimentary tract. When administered it relieves this complex of deficiency symptoms mentioned above, within two or three days; but such symptoms, individually, are not necessarily due to Riboflavin deficiency. It appears to be essential for the maintenance of normal fat-metabolism. Thr probable daily human need of Riboflavin is 4 Mgm.

Nicotinic Acid: Pellagra-preventive factor. (P. P.)

Characters and sources : It was Elvehjem who showed in 1935 that it was a curative factor for Pellagra. It is found in yeast and consists of white crystals or crystalline powder with a feebly acid taste. It is soluble in 75 parts of water at 15°C, and readily soluble in boiling water and alcohol (95%.)

Dose: Nicotinamide. Metric, 0.02 to 0.1 Grm.
Imperial. 1/3 to 1 1/2 Gr. (B. P.).

Uses: Nicotinic acid given orally improves, within a few days, dermatitis, stomatitis, vincent's angina, porphyrinuria, diarrhoea and nervous symptoms of pellagra. If initial doses of the vitamin cause itching of the erythematous areas, facial flushing and faintness, administration is with-held for two days. It prevents porphyrinuria caused by sulphanilamide treatment. Nicotinamide, which is used to prevent and treat Pellagra, does not cause vasodilation and itching of the skin as nicotinic acid may do, and so it is peferable to the latter, for hypodermic administration.

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Information, about a few members of the group B-Complex about which little is known and the relations of which to human nutrition is not established, is given below.

Pyridoxine (Vitamin B_6) Pyridoxine is one of the newer factors of the vitamin B-Complex. In contrast to Thiamin, Riboflavin, and Nicotinic Acid the need of Pyridoxine in human nutrition has not been definitely established, and it has not yet had sufficient trials to warrant its recmmendation in any particular disorder. Its deficiency leads to acrodynia, and retarded growth in the rat, hypochromic anaemia in dogs. Pyridoxin has been tried in the following conditions but its use must be considered to be entirely experimental at present.

Pyridoxin Hydrochloride is stated to improve Myesthenia Gravis, Muscular dystrophy and Paralysis agitans.

Therapeutic doses: Oral doses have varied from 50 to 250 Mg. daily; injections from 50 to 100 Mg. daily or every other day. No definite range seems yet to have been determined.

Folic Acid: The identification of folic acid was first made in experiment done on animals. A nutritional deficiency syndrome in experimental animals has been described, which is relieved by a factor variously termed 'Folic Acid' 'Vitamin Bc'" L Casei factor". Recently, a compound which is identical with "L Casei factor" isolated from liver has been sythesized. Experimental studies indicate that there are atleast three or more compounds occuring in natural materials with Folic Acid activity in different species.

The need of Folic Acid in human nutrition has not been established. Indications are that it plays a fundamental role in blood formation. The synthetic compound has been reported to have anti-pernicious anaemia activity when administered in large doses, but there is no evidence that it is identical with the anti-pernicious anaemia factor in liver extracts. It has also been effective experimentally in other macrocytic anaemias, nutritional anaemia and anaemia of pregnancy and sprue. (Moor 1945 Sharpe 1943).

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Choline; It occurs in nature as a constituent of phospholipids, and is related to the metabolism and distribution of fats. It has been termed a " lipotropic " factor, being concerned in the prevention and restoration to normal of livers affected by fatty infiltration.

Recent clinical investigation to confirm the value of choline in certain types of liver cirrhosis appear favourable. It was tried in a few cases of icterus-neonatorum and was apparently beneficial.

Therapeutic doses of choline have been administered orally and intraveneously in the from of choline chloride, 0.33 Grm. to infants daily, and from 1 to 8 Grm. to adults. Since choline is known to be a circulatory depressant its parenteral administration is not without danger. Orally too, it should not be given on a fasting stomach.

The question has been raised whether choline should be considered a vitamin and a member of B-complex. It may later be classed as an independent nutritional factor in its own right.

VITAMIN C :—The anti-scorbutic factor.

Synonims :—Ascorbic Acid, Vitamin C, Cevitamic Acid.

Sources and characters : The vitamin consists of minute colourless crystals with acid taste, readily soluble in water, Solutions if alkaline or neutral oxidise rapidly. It is however sensative to heat and drying, and disappears rapidly from foods when these are preserved and stored. Although it is present in fresh milk it is destroyed by pasteurisation (150°F.). Dry grain contains no ascorbic acid. In emergency, use may be made of the fact that on germination of seeds such as peas and beans, considerable amounts of vitamine are found. Its richest sources are cabbages, turnips, lemons, oranges and tomatoes. It has been isolated in the pure form from fruit juice, and has also been synthetically prepared. Most animals

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can manufacture this compound and hence are independent of any supply in the form of food. Guinea-pig, man and monkey cannot manufacture adequate quantities of ascorbic acid, become diseased, and die unless they obtain a supply in their food.

Standard and dose:—Ascorbic acid possesses anti-scorbutic properties, The international unit is 0.05 Mgm. of pure l-ascorbic acid. The daily human requirement is about 50 Mgm.

Dose :—Prophylactic (daily). 500 to 1000 Units,
Imperial 2/5 to 4/5 Gr.
Therapeutic (Daily) 2000 to 5000 Units.
Imperial 1 1/2 to 4 Grs.

A pint of average commercial milk contains about 5 Mg., raw fresh milk contains about 14 Mg. of Vitamin C. Fresh orange juice contains 50 Mg. per 100 Mils (3¼ Oz.).

Storage and elimination: The adrenal cortex, liver and kidneys store reserves of ascorbic acid, excess of which is excreted in the urine at an avarage rate of 10 to 25 Mg. daily.

Deficiency symptoms: Lack of Vitamin C impairs cellular oxidation, reduction and formation of red blood-cells. The Vitamin is a strong reducing agent and probably is an essential factor in the complex enzyme system which enables the cells to utilise oxygen.

Capillary fragility is produced by complete deprivation of absorbic acid. There is however some doubt whether this effect is due to lack of ascorbic acid, or Vitamin 'P' (Hesperidin), which also is present in citrus fruit.

The chief symptoms which this deficiency leads to are malnutrition with lowered resistance and eventually scurvy. In adults swelling, hoemorrhages and ulcers are noticed, and in infants capillary fragility, swelling and bleeding of the gums, pain and tenderness in the limbs, and enlargment at the costo-chondral junctions are observed. Microcytic anaemia occurs in eighty per-cent of cases of adult-scurvy where lack of ascorbic acid is generally the cause.

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Uses : Ascorbic acid is preventive and curative in infantile and adult scurvy. In mild cases oral dosage is sufficient and usually given in the form of lemon, orange or tomatoe juices, But in severe cases intravenous or intramuscular injections, daily of 50 to 100 Mgs. dissolved in 5 C. C. of Normal Saline solution are given ; it is always desirable to neutralize the acid before use, by adding to the solution half these weights of Sodium Bicarbonate.

Ascorbic Acid has also been found valuable in the treatment of capillary hoemorrhages, hoemoglobinuria, and badly healing ulcers. It has been used in psoriasis, arsenical dermatitis, and sulphanilamide poisoning. It is useful in febrile conditions as it has the power of increasing the vital resistance.

Vitamin ' P '

It is a water-soluble crystalline substance of the flavone group related to Hesperidin. It occurs naturally with ascorbic acid, in lemon juice. It is said to be a factor which decreases capillary fragility and maintanis normal permeability. It is used in hoemorrhagic diseases. It is on trial in some varieties of Purpura.

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